NOT TOO SCARED TO THINK CAREFULLY: OPTIMISM FOSTERS PROCESSING OF SELF-RELEVANT THREATENING PERSUASIVE MESSAGES

by

Watcharaporn Pengchit

A dissertation submitted to the faculty of
The University of Utah
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

Department of Psychology

The University of Utah

December 2010

The University of Utah Graduate School

STATEMENT OF DISSERTATION APPROVAL

The dissertation of **Watcharaporn Pengchit**

has been approved by the following supervisory committee members:

Lisa Aspinwall	, Chair	**10/7/2010** Date Approved
David M. Huebner	, Member	**10/7/2010** Date Approved
Anita Kinney	, Member	**10/7/2010** Date Approved
Frederick Rhodewalt	, Member	**10/7/2010** Date Approved
Paul H. White	, Member	**10/7/2010** Date Approved

and by **Cynthia A. Berg**, Chair of the Department of **Psychology**

and by Charles A. Wight, Dean of The Graduate School.

ABSTRACT

The role of dispositional optimism, confidence about experiencing favorable future outcomes, in processing and using health-threatening information in making attitudinal judgments about health-promotion behavior is underexplored. The valence-enhancement hypothesis posits that optimism enhances attitude change following both self-relevant positive and negative messages. We, however, predicted that optimism would increase elaborative processing of and buffer negative affective responses to self-relevant, health-threatening information. In Study 1 (N = 130), undergraduate students consuming caffeinated drinks regularly were presented with either negative or positive hypothetical cardiac consequences of caffeine consumption supported by either strong or weak evidence. Optimism predicted greater elaboration and less negative affect in response to the negative messages, regardless of argument strength. Optimism predicted greater negative thoughts about caffeine use following the negative message. Optimists' greater negativity of thoughts about caffeine use and less negative affective response following the negative messages explained their subsequent attitudes toward caffeine use. These findings confirmed the beneficial roles of optimism in facilitating cognitive elaboration and buffering unpleasant emotional consequences of health-threatening messages, while increasing responsiveness to information about potential negative outcomes involving health. Study 2 (N = 124) tested whether optimists' attitudes toward a recommended health behavior following fear-arousing information varied as a function

of personal risk and response efficacy. Undergraduate students were presented with information about Repetitive Strain Injury (RSI) and received false feedback that they were either at high or low risk. Participants were then offered an RSI-prevention training program described as high, moderate, or low in effectiveness. Dispositional optimism predicted enhanced positive attitudes toward the highly effective training, both in the low- and especially in the high-risk condition. When the training was ineffective, optimism predicted greater counterarguments against the fear-arousing information about RSI. Optimists' lower counterarguments against RSI explained their especially positive attitudes toward the highly effective training. Based on the patterns of optimists' responsiveness to potential outcomes of performing recommended behaviors, we propose an extension of the valence-enhancement hypothesis: Optimistic beliefs not only promote attitude enhancements as a function of message valence, but also the valence of the consequences of accepting the persuasive messages.

I dedicate this dissertation work to my family, especially to my parents, for their unconditional support and optimistic belief in my abilities.

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Optimism, defined as generalized favorable expectancies regarding future events (Scheier & Carver, 1985), has been consensually identified as a crucial factor associated with people's greater well-being and adaptive adjustments to various kinds of difficulties in life (e.g., Aspinwall & Taylor, 1992; Brissette, Scheier, & Carver, 2002; Carver et al., 1993; Rasmussen, Wrosch, Scheier, & Carver, 2006; Scheier & Carver, 1985, 1992; Taylor et al., 1992). Dispositionally optimistic people, those who generally expect favorable future outcomes, typically report better mental and physical health (Robbins, Spence, & Clark, 1991; Ruthig, Chipperfield, Newall, Perry, & Hall, 2007; Scheier & Carver, 1992; Solberg Nes & Segerstrom, 2006; Taylor & Brown, 1988). Research has consistently found that optimists' active and problem-focused coping styles, and, in some cases, lower use of avoidant coping are responsible for these benefits (Aspinwall & Taylor, 1992; Brissette et al., 2002; Carver et al., 1993; Hatchett & Park, 2004; Nicholls, Polman, Levy, & Backhouse, 2008; Segerstrom, Taylor, Kemeny, & Fahey, 1998; Taylor et al., 1992; see also Aspinwall, Richter, & Hoffman, 2001; Solberg Nes & Segerstrom, 2006; Taylor & Aspinwall, 1996; Wrosch & Scheier, 2003 for reviews).

Numerous studies have tested how optimists successfully cope with various types of stressors and threats (e.g., adjustment to college, Aspinwall & Taylor, 1992; sexism, Kaiser, Major, & McCoy, 2004; breast cancer treatment, Matthews & Cook, 2009). However, relatively few studies have focused on a critical earlier step in the coping

process, namely, how optimists and pessimists differentially approach threatening information that may be important for taking precautions against potential threats. To date, optimists have been found to pay greater attention to and engage in elaborate processing of useful threatening information, while pessimists tend to avoid such information (Aspinwall & Brunhart, 1996, 2000; Kaiser et al., 2004). Moreover, a small amount of research has examined the ways in which optimists use negative (and positive) information in making judgments and in changing their attitudes and behaviors. Only one published study has directly investigated how dispositional optimism influenced people's responses to persuasive messages (Geers, Handley, & McLarney, 2003). With this in mind, the aim of the current research was to elucidate the role optimism plays in persuasion. Specifically, we explored the way in which optimistic beliefs influenced cognitive and affective responses to, processing of, and attitudinal judgments in response to health-promotion recommendations following exposure to health-threatening persuasive messages. Doing so enhanced understanding of the possible pathways through which optimism has been linked to better health.

Optimists' Processing of Threatening Information

Research provides relatively consistent findings indicating that optimists pay greater attention to rather than avoid threatening information, especially self-relevant information (Abele & Gendolla, 2007; Aspinwall & Brunhart, 1996; Kaiser, Major, & McCoy, 2004). In a study by Aspinwall and Brunhart, participants high in health-related optimism who reported high vitamin use spent the longest time reading risk information when offered a chance to freely read neutral, benefit, and risk information about taking

vitamins, while optimists who were low vitamin users spent the least time reading such information. The results of a surprise recall test also paralleled these findings. Although Aspinwall and Brunhart did not find the same results for tanning behavior, they concluded that optimists' attention to health information seems to be selective such that optimists paid attention to threatening information, especially when it was personally relevant (see also Aspinwall et al., 2001). In processing such information, research evidence suggested that optimists elaborated on health-threat information to a greater extent than did pessimists (Aspinwall & Brunhart, 2000). In a series of studies examining how optimists managed health-related risks, Aspinwall and Brunhart (2000) asked regular tanners to read risk, benefit, and neutral information pertaining to melanoma by using a menu on the computer screen to access the information. Participants were then interviewed about their thoughts and feelings as they were navigating through the different kinds of information. It was found that dispositional optimists showed greater elaboration in processing the information regarding the risks of tanning only when they were told that melanoma was pervasive in their age group (as opposed to older people), and this elaboration did not entail arguing against the risks of tanning. This careful investigation of optimists' processing of threatening information and the findings based on recall and recognition tasks of other studies (Abele & Gendolla, 2007; Aspinwall & Brunhart, 1996; Kaiser et al., 2004) indicated that optimists effortfully scrutinize threatening information to a greater extent than do pessimists, especially when the information is potentially personally relevant.

Optimists Reap Better Outcomes via Flexible Approach Coping

Why do optimists face unpleasant information head on? Kaiser et al. (2004) demonstrated the role of optimistic beliefs in an initial step of coping, namely, coping appraisal, such that optimists appraised stressful stimuli as less threatening because they believed that they had greater coping resources to deal with them. Optimists thus fared better emotionally in the face of threatening information about prejudice against their own gender. Appraisal has been defined as cognitive interpretation of a potential stressor (Lazarus & Folkman, 1984). In conceptualizing stress appraisal processes, Lazarus and Folkman distinguished between primary and secondary appraisals. While primary appraisal refers to cognitive evaluation of how threatening the stressor is, secondary appraisal is a judgment of what one can do to eliminate the stressor, which reflects whether the person perceives that he or she has adequate coping resources to deal with the stressor. Research documented that optimists believed that they had greater resources or capabilities to deal with stressors compared to pessimists (Chang, 1998; Kaiser et al., 2004; Peacock & Wong, 1996).

Optimists' belief that they have greater capabilities to deal with adversity leads them to confront rather than avoid the threat. A number of studies have consistently and uniformly found that optimists and pessimists cope differently with adversity such that optimists tend to engage in active, approach-oriented, and problem-focused coping aimed at eliminating stressors or the negative emotional consequences of facing stressors, while pessimists employ more avoidant strategies, such as denial of or withdrawal from stressors (Aspinwall & Taylor, 1992; Carver et al., 1993; Scheier et al., 1989; Scheier, Weintraub, & Carver, 1986; Solberg Nes & Segerstrom, 2006 for a review; see also

Aspinwall & Taylor, 1997). In their recent meta-analysis, Solberg Nes and Segerstrom (2006) concluded that optimism was positively related to approach coping strategies aimed at managing challenges or the emotional consequences of dealing with challenges, and negatively linked to avoidance coping characterized by avoidance or withdrawal of effort in managing stressors.

Research suggests that in addition to employing approach coping, optimists adjust their coping strategies according to features of the situation. Scheier et al. (1986) investigated the differences between dispositional optimists and pessimists in using coping strategies. They asked participants to complete The Ways of Coping Checklist to indicate their attempts in coping with the most stressful situation they encountered in the last 2 months. The subjects also had to report their perceived degree of control over that situation. The results revealed that optimism was positively associated with problem-focused coping and positive reinterpretation especially when the situation was perceived controllable and with acceptance or resignation in uncontrollable situations. These findings suggested that optimistic people deal with a problem actively when they believe that it can be solved. However, in situations they do not believe to be amenable to problem-solving effort, optimists accept a defeat and do not turn to use maladaptive strategies such as denial, self-blame, or continued persistence.

In line with the findings of Scheier et al. (1986), Aspinwall and Richter (1999) found that optimists displayed a potential to be flexible in pursuing their goal. Optimists and pessimists were asked to solve anagrams as part of a verbal intelligence test by rearranging groups of letters into meaningful words within a 20-minute time limit. In one condition, there were only seven unsolvable anagrams, but in the other condition there

were two additional solvable sets of anagrams that were added as an alternative way to demonstrate high verbal intelligence. Highly optimistic participants disengaged from unsolvable anagrams almost 4 minutes sooner than their pessimistic peers when they had a choice to work on alternative anagrams, even though the disengagement was permanent. As a result, optimists solved more subsequent anagrams correctly. These findings suggested that optimists did not persist in working toward goals without reassessing the outcomes. If the current strategy did not appear to be effective in pursuing goals, optimists withdrew their effort and tried other strategies.

There is also evidence that optimists use their coping resources strategically. As discussed earlier, health-specific optimists in the Aspinwall and Brunhart (1996) study paid greater attention to health-threatening information only when it pertained to the self (i.e., when they were practicing the health behavior). Consistent with these findings, Abele and Gendolla (2007) found that optimists allocated processing resources according to personal relevance level. Optimists who were highly active exercisers showed better immediate and delayed recall of information about exercise compared to both optimists who did not exercise and to pessimists. In sum, besides potential flexibility in deploying coping strategies, optimists appeared to utilize their coping and processing resources selectively in attending to and processing health-related information in ways that enhance better outcomes.

Optimism and Persuasion

As optimists appear to selectively process self-relevant threatening information, Geers et al. (2003) hypothesized that they would be more responsive to level of personal

relevance and valence of persuasive information as compared to pessimists. Geers and colleagues expanded the role of optimism into persuasion contexts by proposing the valence-enhancement hypothesis, which predicts that optimism is associated with biased processing of both negative and positive persuasive messages that are self-relevant. That is, optimists will elaborate equally on positively- and negatively-framed messages. However, their processing is predicted to be biased such that optimism will enhance the effects of message valence, resulting in more positive responses to positive messages and more negative responses to negative messages. Geers et al.'s series of experimental studies provided support for this hypothesis. Specifically, they found that when presented with a new tuition plan described to be either favorable (the new tuition plan would be a good opportunity for students to reduce their tuition by working part-time for the university) or unfavorable (the new tuition plan would be a burden for students because it requires all students to work part-time for the university), optimistic students were more persuaded by the positive message and less persuaded by the negative message (to agree with the new tuition plan), regardless of the argument quality of the messages. These findings suggest that optimists respond more to valence than to quality of the persuasive messages, leading to what Geers and colleagues called biased processing.

However, some important issues need to be considered before accepting the conclusion that optimists respond more to valence than to quality of persuasive messages. First, the finding of Geers et al. (2003) that optimists failed to differentiate between strong and weak argument contradicts those of Aspinwall and Brunhart (1996, 2000), who found that optimists showed greater attention to and scrutiny of self-relevant health-

risk information as compared to pessimists. Second, the topics of persuasion in the studies of Geers et al. (tuition and extra credit policies) are relatively uncontrollable events for students. School policies, especially tuition, are not likely determined by students' opinions. This low personal control over the situation might foster decreased personal relevance of the persuasive message to students. A third, related point, is that because optimism is associated with active planning and initiation of action in order to resolve a problem, it is important that the protocol used to test responses to persuasive information allow for exertion of such efforts. In Geers and colleagues' study, however, optimists appeared to have a relatively passive role in initiating changes in the new tuition plan even if they did not like the policy. Finally, if, as it is argued here, optimism's active coping is particularly crucial when people are confronted with adversity, optimistic beliefs should be examined as a psychological resource in situations that pose a significant threat, such as when one confronts health-risk information (see Rasmussen et al., 2006). Although the negative message in the study of Geers and colleagues might be threatening to students as it could directly impact their school life, a threat to one's physical health (e.g., risk for a disease) might be more threatening as it directly involves one's well-being and can possibly impact every aspect of one's life. Therefore, the present studies suggested that the role of optimism in persuasion should be tested as a personal resource, especially when individuals confront threatening persuasive information about their health.

Unanswered Questions About Optimism and Persuasion

From the research literature discussed earlier, some issues related to the role of optimism in information processing and persuasion need to be carefully investigated. First and foremost, the role of optimism in responding to persuasive messages needs to be carefully tested. Examination of how optimistic beliefs influence attitude change in the context of health-risk communication will extend prior research, especially in regards to the influence of optimism on the processing of threatening persuasive messages. In the study of Geers et al. (2003), optimists exhibited similar patterns in their responses to both negative and positive messages about the new tuition policy—optimists favored the positive message and disfavored the negative one to a greater extent than did pessimists. However, for health behaviors for which people tend to defend their preferences in response to inconsistent or threatening information rather than to process it objectively (i.e., defensive biases, Das, de Wit & Stroebe, 2003; Liberman & Chaiken, 1992), optimism may affect this defensive response by helping individuals cope with such information more adaptively. This effect, however, may not be evident when individuals process preference-consistent information (i.e., positive messages) because such information supports rather than argues against their health behavior.

Second, while there is consistent evidence that optimists show less defensive biases toward threatening information, how optimists process positive or encouraging information has been a neglected issue. The only study that tested how optimists responded to personally relevant positive information found no relation between optimism and attention to information about benefits regarding health practices (Aspinwall & Brunhart, 1996). Because accepting good news without careful

consideration could lead to harmful consequences, such as ignorance of possible negative side effects, the current research aimed to examine how optimists and pessimists process positive information.

Third, due to seemingly inconsistent findings regarding the extent of cognitive elaboration on self-relevant information for optimists, the present study aimed to carefully explore this issue by including multiple measures of cognitive elaboration. In addition to a thought-listing task (Cacioppo & Petty, 1981) widely used to assess participant's cognitive responses to persuasive messages, objective assessments of message elaboration, as well as self-ratings of cognitive effort (used by Liberman & Chaiken,1992) were used to carefully examine the extensiveness of optimists' and pessimists' processing of negative and positive persuasive messages. These measures provided strong evidence of whether optimism facilitated approach-oriented rather than defensively avoidant processing of health-threatening information.

Finally, a study that assessed optimists' and pessimists' affective responses to threatening information showed that optimists expressed fewer depressed emotions as a result of exposure to information about sexism against their own gender group, due in part to perceived greater coping resources (Kaiser et al., 2004). However, the authors did not examine how the affective responses influenced optimists' and pessimists' subsequent judgments. Interestingly, affective responses to emotional persuasive messages have been found to influence attitude change by reflecting the impact of cognitive factors in persuasion such as argument quality (Rosselli, Skelly, & Mackie, 1995; Zuwerink & Devine, 1996). As self-relevant negative (threatening) and positive (encouraging) persuasive messages would potentially elicit emotional responses' from

individuals, the current studies explored the role of affective responses to persuasive messages in optimists' attitudinal judgments.

Moderating Role of Optimism in Processing Positive and Negative Messages

Research on persuasion and attitude change has conceptualized the valence of persuasive messages in different ways. Geers et al. (2003) provided students with messages about a new tuition plan framed positively and negatively. Research on health promotion, on the other hand, has pervasively utilized fear appeals in persuading people to take care of their health. However, the most important concern in using negative (i.e., threatening) messages in health persuasion is that people tend to trivialize the seriousness of their health risks in order to avoid negative feelings and/or to protect their self-concept (Das et al., 2003; de Hoog, Stroebe, & de Wit, 2005; Ditto & Lopez, 1992; Jemmott, Ditto, & Croyle, 1986). Although motivation to carefully process aversive information is heightened by factors such as personal relevance, personal relevance only enhances elaboration of defensive processing (Kunda, 1990; Liberman & Chaiken, 1992). For instance, Liberman and Chaiken (1992) found that women who drank coffee regularly agreed less with and were more critical of a message suggesting a link between caffeine and fibrocystic breast disease than a message disconfirming the link. In fear-arousing communications, high susceptibility to a health risk has been found to induce defensive motivation when the threat is severe, resulting in overly positive evaluations of action recommendations (Das et al., 2003; de Hoog et al., 2005). However, this positive bias is significantly minimized by an induction of positive mood that increases differentiation

between strong and weak action recommendations (Das & Fennis, 2008). This finding indicates that having adequate personal resources is crucial for coping with threatening information. Optimism, which is associated with more adaptive coping, therefore was expected to foster less defensive processing of threatening health information.

Researchers studying responses to self-relevant health information have also found that people are generally less likely to question the validity of positive or desirable information (Ditto & Lopez, 1992). However, we did not have a clear understanding of how optimism influenced this tendency. Because processing self-relevant positive information is less likely to be threatening to individuals, personal resources in coping, including optimism, are possibly not necessary and/or not involved. We predicted that the influence of optimism would be less pronounced when processing positive information compared to negative information. Both optimists and pessimists might accept good news indiscriminately (that is, without regard to message quality) because for optimists, such information would be consistent with their favorable future expectations of optimists, while for pessimists, such information could help repair negative moods and boost psychological resources.

Moderating Role of Optimism in Processing

Strong and Weak Messages

Message quality is an important determinant of attitude change in that it may intensify or mitigate cognitive and affective reactions to persuasive messages. Specifically, a message supported by strong evidence generally elicits greater agreement, while a weak message may lead to greater counterarguing and less successful persuasion.

In general, when the audience is motivated to think carefully about the topic, high personal relevance of the topic leads to more favorable responses to the strong message and less favorable attitudes toward the weak message (Petty & Cacioppo, 1979). In other words, responses to argument strength are good indices of the extent of an audience's motivation and ability to process persuasive information. Individuals motivated to carefully and/or objectively scrutinize persuasive messages tend to show differentiation between strong and weak arguments, for example, of the action recommendations following a fear appeal (Das & Fennis, 2008; Das et al., 2003; de Hoog et al., 2005). Therefore, in addition to using a thought-listing task to assess extensiveness of thoughts elicited by persuasive messages, manipulating argument strength in Study 1 allowed us to also test recipients' motivation to accurately process messages.

In Das and colleagues' studies on fear appeals, strong and weak arguments supporting an action recommendation (e.g., joining a stress management training) imply that the effectiveness of the recommended action is either assured or not. Study 2 extended this test by varying the effectiveness of the action recommendation (e.g., high, moderate, or low) in order to test the moderating role of optimism. It was expected that optimists would show less defensiveness in dealing with fear-arousing information and therefore would be able to differentiate among the recommendations that vary in their effectiveness.

Mediating Processes of Attitude Change

Cognitive elaborations have been viewed as a central mediating process of attitude change in most contemporary theories of persuasion (e.g., Elaboration Likelihood

Model, Petty & Cacioppo, 1986; the Heuristic-Systematic Model, Chaiken, 1980, 1987), which implies that cognitions are the most influential determinant of attitudes. However, not all persuasive messages are meant to directly influence cognitions related to attitude objects. Persuasion utilizing effects of moods works by eliciting feelings such as fear (Leventhal, 1971) in health communications (Stephenson & Witte, 1998; Witte, 1992, 1994; Witte, Berkowitz, Cameron, & Lillie, 1998) or humor in consumer research (e.g., Chen, Grube, Bersamin, Waiters, & Keefe, 2005).

Some researchers emphasized the largely overlooked role of affective responses on persuasion (e.g., Rosselli et al., 1995; Zuwerink & Devine, 1996). Rosselli et al. assessed cognitive and affective responses separately by asking participants to write down all the thoughts and feelings they had while reading either rational or emotional counterattitudinal messages that argued either in favor of or against using animals in research. They found that emotional messages triggered greater affective rather than cognitive responses, and the valence of the affective responses depended upon argument quality, such that strong arguments elicited more positive emotional responses. Path analytic results showed that, in addition to cognitive responses, affective responses acted as a mediator of the relationship between argument quality and message acceptance in those who received emotional messages. Emotional responses to persuasive messages therefore may contribute to attitude change in addition to the more typically studied cognitive elaborations.

Considering the evidence that optimists show less negative emotional responses after processing self-threatening information concerning prejudice compared to pessimists due to their greater perceived coping resources (Kaiser et al., 2004), optimists'

affective responses may play a role in their attitudinal judgments through their emotional responses to a persuasive message. Specifically, because of optimists' superior coping resources (i.e., belief that a health threat is manageable), they might feel less distressed after exposure to health-threatening persuasive information. Such affective response may signify that the health threat is less harmful, leading optimists to view the threat in a more positive light (e.g., smoking is not too bad). This idea is in line with the mood congruency framework (e.g., Bower, 1981; see Bower & Forgas, 2001 for a review), which posits that moods increase cognitive accessibility of mood-congruent materials in memory. In other words, optimists' less negative mood may bring up less negative aspects of an attitude object, resulting in a mood-congruent judgment in favor of the object. Pessimists, whose emotional responses to threat are more negative, might be more likely to dwell on negative attributes of the attitude object and thus make negative attitudinal judgments about it.

Optimists' perception of greater coping resources may also affect their attitude change cognitively. Health communication theories such as the Health Belief Model (HBM, Janz & Becker, 1984) and the Extended Parallel Process Model (EPPM, Witte, 1992) focus on recipients' perceptions of health problems and actions to avert these problems as mediators of acceptance of the recommended action. The HBM, for instance, proposes that individuals will be most likely to adopt a suggested health behavior when four components are present: (a) individuals feel vulnerable to a threat (perceived susceptibility), (b) the threat is serious (perceived severity), (c) individuals believe that performing the recommended action is an effective means to avert the threat (perceived benefits), and (d) performing the recommended action involves low costs or

negative consequences (perceived barriers). Similarly, the EPPM posits that if threat perceptions (susceptibility and severity) are high but not greater than efficacy perceptions (response efficacy and self-efficacy), individuals will be more likely to take a suggested action to manage the threat. However, if threat perceptions exceed perceived efficacy, people will instead focus on alleviating fearful feelings by adopting maladaptive behavior, such as avoiding thinking about the threat. Due to optimists' superior coping resources, they might believe that the threat is under control, leading to increased perception of efficacy to approach and manage the threat. Consequently, optimists may face the potential health threat and change their attitude in a way that would reduce their likelihood of experiencing the negative health outcomes (e.g., changing attitudes toward the threatening attitude object to be less favorable).

In sum, we suspected that optimists' affective and cognitive responses to persuasive messages could potentially have countervailing effects on subsequent attitudes. Due to the evidence that optimists' attitude change is determined by cognitive responses to persuasive message (Gees at el., 2003) and that optimists effortfully process health-threatening information to a greater extent than do pessimists (Aspinwall & Brunhart, 1996, 2000), we predicted that optimists' attitudes would be more strongly determined by their cognitive elaboration of the health-threatening persuasive message than their affective responses to the health threat.

Overview of the Studies

The main purpose of the current studies was to examine the role of optimism in processing of persuasive messages and judgmental outcomes, including attitudes and

subsequent behavioral intentions, with respect to action recommendations in the context of health prevention. Studies 1 and 2 aimed to test 1) whether optimism moderated the effects of message valence, argument strength, and personal relevance on attitude change, and 2) If cognitive and affective responses to the persuasive messages explained the relationship between the predictors and attitude change. The proposed studies represented the first attempt to understand how optimism moderated judgmental responses to threatening persuasive messages in a health context and how both cognitive and affective responses to persuasive messages may explain the effects of optimism under different conditions.

STUDY 1: OPTIMISM AND PROCESSING OF NEGATIVE AND POSITIVE PERSUASIVE MESSAGES

Study 1 was designed to provide an initial test of how optimism predicted processing of persuasive messages that varied in valence and argument strength (while personal relevance was high--the topic of persuasion was relevant to individuals' own health behaviors), as well as to test the mediating role of both cognitive and affective responses in attitude change regarding health behavior. In this experimental study, participants received a persuasive message that either reinforced or argued against their current health behavior and was supported by either strong or weak evidence.

Hypotheses

First, if the valence-enhancement hypothesis of Geers et al. (2003) holds true that optimists respond more to message valence than argument quality, we should obtain greater unfavorable final attitudes in optimists who receive a negative message and greater favorable final attitudes in optimists who receive a positive message compared to pessimists, regardless of argument quality. However, if optimism facilitates less defensive or more objective processing of threatening information, optimists who receive the negative message would show greater difference in attitude change (toward the health behavior) between strong and weak threatening messages as compared to pessimists, by reporting greater attitude change when argument quality is strong than when it is weak.

However, when the message encourages the health behavior they are practicing, optimists and pessimists should not differ in attitude change in the direction of agreement with the positive message, regardless of argument strength.

Second, in addition to cognitive responses, emotional responses to the message were predicted to mediate the effects of optimism, message valence, and argument strength on attitude change. Optimists were predicted to report less negative emotional responses to the strong negative message than pessimists, and these emotional responses were predicted to contribute to emotion-consistent attitudes. However, optimists and pessimists were expected to show the same degree of positive emotional responses to the positive message regardless of its argument strength because for optimists, positive messages would be consistent with their favorable expectancies, whereas for pessimists, such messages would potentially boost their psychological resources.

Method

Participants

Participants were 130 undergraduate students from the University of Utah who consumed caffeinated beverages regularly. The average age was 22.77 years and 60% of the sample were female. Participants received research participation credit in undergraduate psychology courses.

Design

Study 1 employed a dispositional optimism (continuous measure) x 2 (message valence: negative versus positive) x 2 (argument strength: strong versus weak) between-

subjects design. All participants were randomly assigned to one of four cells.

Procedure

Participants completed the study in groups of up to four and were informed that the study involved assessing how laypeople or nonscientists understand medical information related to health issues. Participants first completed computerized measures of their daily consumption of caffeinated beverages (e.g., coffee, tea, caffeine-containing soda) and attitudes toward caffeine consumption (pretest) embedded in a general health survey that measured various health-related topics. Participants then completed a set of individual difference measures, including dispositional optimism and other individual differences related to optimism.

Next, participants were asked to read one of the four persuasive messages described as a medical report presenting a new finding in health research. The one-page persuasive message contained approximately 560 words with an introduction, research evidence, and a summary structured into six paragraphs (see Appendix A for examples of the persuasive messages). Participants received either a positive or negative message that contained either strong or weak evidence concerning the effects of caffeine on cardiac function. After reading the fictitious medical report, participants' attitudes toward caffeine consumption (posttest) and intention to reduce/increase caffeinated drink intake were measured. Participants' cognitive and affective responses to the message were then assessed. Finally, participants completed manipulation check items followed by a careful debriefing.

Measures and Materials

Measures of Optimism and Other Individual Differences

Dispositional optimism. The Life Orientation Test-Revised (LOT-R, Scheier, Carver, & Bridges, 1994), consisting of six core and four filler items, was used to assess dispositional optimism (α = .81). The core items contain three positively-worded (e.g., "In uncertain times, I usually expect the best.") and three negatively-worded items (e.g., I hardly ever expect things to go my way), each of which was rated on a 5-point Likert scale ranging from 1 (*I disagree a lot*) to 5 (*I agree a lot*). To calculate a dispositional optimism score, the three negatively-worded items were reverse scored and added to the three positively-worded items. The total score was averaged to create an optimism score, with higher numbers reflecting greater optimism.

Individual differences related to optimism. Several researchers (e.g., Benyamini & Roziner, 2008; Fontaine & Jones, 1997; Lancastle & Boivin, 2005; Marshall & Lang, 1990; Smith, Pope, Rhodewalt, & Poulton, 1989) have argued that dispositional optimism is indistinguishable from individual difference constructs such as neuroticism, self-esteem, positive affectivity, and self-mastery. We thus included measures of five other individual differences that have been proposed to account for some of the benefits of optimism in the present study to assess the unique relation of optimism to persuasion outcomes. Specifically, neuroticism (12-item NEO-FFI, Costa & McCrae, 1992; α = .82), self-mastery (Pearlin & Schooler, 1978; α = .72), positive affectivity (10-item PANAS-P, Watson & Clark, 1994; α = .87), self-esteem (Rosenberg, 1965; α = .90), and naïve optimism (a 15-item scale, Epstein & Meier, 1989; α = .83) were measured. The items in each measure were averaged to form scales.

Manipulations of Predictors

Message valence. Half of the participants were assigned to read a medical report briefly describing three fictitious new research studies that found a negative impact of caffeine consumption on heart valve function (negative message condition) with a recommendation to decrease caffeine consumption. The other half read a fictitious medical report containing three new studies suggesting a benefit of caffeine consumption in facilitating the function of heart valves (positive message condition) with a recommendation to increase caffeine consumption. To increase the credibility and personal relevance of the persuasive message, the medical report also contained a picture of a young adult (male for male participants, female for female participants). In the negative message condition, the model clearly displayed pain and suffering from heart problems and held a caffeinated drink in one hand, whereas in the positive message condition, the same model expressed pleasant emotions while holding the same caffeinated drink.

Argument strength. The argument strength manipulation (adapted from Liberman & Chaiken, 1992) was orthogonal to the message valence manipulation. In the strong argument condition, the medical report contained research that had no methodological flaws and had consistent results among the three studies regarding the effects of caffeine on heart valve function. In the weak argument condition, the reported studies contained methodological flaws or weaknesses and inconsistent findings about the effects of caffeine on heart valve function.

Main Outcomes

Attitudes toward caffeine consumption. To measure attitudes concerning caffeine consumption, participants were asked to indicate how good, bad, beneficial, harmful, and healthy they thought caffeine consumption was (adapted from Raghunathan & Trope, 2002) on a scale from 1 *(not at all)* to 9 *(very much)*. The same set of questions was used to assess participants' attitudes both pretest and posttest. Responses from all five items (α = .86 for the pretest and .88 for the posttest) were averaged to create a baseline and a postmessage attitude index.

Intention to change caffeine consumption. Following the posttest measure of attitude, participants were asked to indicate if they should, will try to, and are going to decrease/increase caffeine consumption using question such as "How likely is it that you will try to decrease/increase your caffeine consumption in the next month?" on a scale of 1 (*not at all*) to 9 (*very likely*; Raghunathan & Trope, 2002). The three intention items formed a highly reliable measure (α = .94).

Cognitive and Affective Reponses to the Persuasive Messages

Thought-and-feeling listing tasks. Immediately after filling out the measure of attitudes and intention, participants were asked to type in any and all reactions they had while reading the message, including thoughts and feelings, regardless of relevance to the message. The instructions were adapted from Rosselli et al. (1995) who modified the instructions of traditional thought-listing tasks to include report of affective responses.

Extensiveness of Message Processing

Self-rating of cognitive effort. To measure participants' cognitive effort in processing the message, they were asked to indicate how much effort they put into trying to understand and think about the content of the medical report on a single item measure using a scale from 1 (*not at all*) to 9 (*very much*; adapted from Liberman & Chaiken, 1992).

Objective rating of message scrutiny. To assess the extent of message processing from participants' cognitive and affective responses to the thought-and-feeling listing tasks, two judges independently evaluated the content of participants' responses in terms of how elaborate responses were with regard to caffeine consumption on a scale of 1 (lowest message elaboration) to 10 (highest message elaboration). The judges were instructed to take into account both quality and quantity of the responses.

Results

Preliminary Analyses

Manipulation Check

Message valence. Three questions (e.g., How threatening did you find the medical report to be for you?, with 1= *not at all*, 9 = *very much*) were used to check the message valence manipulation. A two-way Message Valence x Argument Strength Analysis of Variance (ANOVA) indicated a significant main effect of message valence, (F (1, 126) = 310.72, $p < .001$), such that participants in the negative message condition (M = 6.78, SD = 1.67) had higher ratings of message negativity than those in the positive message condition (M = 2.11, SD = 1.44). However, there was also a significant

interaction between message valence and argument strength (F (1, 126) = 6.29, $p < .05$) indicating that participants rated strong negative messages (M = 7.44, SD = 1.35) as more negative than weak negative messages (M = 5.96, SD = 1.67), while there was no difference in rating of message negativity between strong positive (M = 2.20, SD = 1.68), and weak positive messages (M = 2.02, SD = 1.20).

Argument strength. Participants were asked to rate how convincing, strong, and persuasive the message was (e.g., "How convincing did you find the medical report to be?) on a 9-point scale (1= *not at all*, 9 = *very much*). A two-way ANOVA indicated a significant main effect of argument strength (F (1, 126) = 45.34, $p < .001$) on participants' rating of argument strength, suggesting that participants who received the strong argument (M = 5.01, SD = 2.16) rated the message as stronger that those who received the weak argument (M = 3.75, SD = 1.70). There was also a significant main effect of message valence (F (1, 126) = 10.96, p = .001) suggesting that participants in the negative message condition (M = 4.98, SD = 1.92) rated the message as stronger than did those in the positive message condition (M = 3.79, SD = 2.00). There was no interaction between argument strength and message valence.

Descriptive Statistics

Correlations among optimism, the other individual difference measures, and the outcome measures are presented in Table 1.

Table 1

Correlations and Means of Optimism, Related Individual Differences, and Attitudes Toward and Intention to Change Caffeine Consumption.

	1	2	3	4	5	6	7	8	9
1. Dispositional optimism	--	.08	-.02	.08	-.54***	.59***	.64***	.56***	.42***
2. Baseline attitude		--	.47***	-.07	-.16	.16	.17^{+}	.06	-.17^{+}
3. Postattitude toward caffeine consumption			--	-.40***	.15	.02	.03	-.04	-.04
4. Intention to change caffeine consumption				--	-.15	.20*	.11	.12	-.09
5. Neuroticism					--	-.44***	-.70***	-.46***	.20*
6. Self-mastery						--	.59***	.49***	.21*
7. Self-esteem							--	.61***	.34***
8. Positive affectivity								--	.46***
9. Naïve optimism									--
M	3.76	3.94	4.31	3.69	2.77	5.57	3.94	3.53	3.59
SD	0.73	1.25	1.37	2.48	0.71	0.81	0.74	0.60	0.49
Range of Score	1-5	1-9	1-9	1-9	1-5	1-7	1-5	1-5	1-5
N	126	130	130	130	130	130	130	130	130

Note. $^{+}p < .06$. $*p < .05$. $**p \leq .01$. $***p \leq .001$.

Primary Results

Attitude Change and Intentions

To test the main predictions for whether optimism, message valence, and argument strength predicted attitude change and intention to change caffeine consumption behavior, hierarchical regression analyses were performed. In the first step, we controlled for age, gender, and baseline attitude for the analyses predicting postmessage attitudes. Next, the main effects of dispositional optimism (centered), message valence (dummy coded), argument strength (dummy coded), and amount of caffeine consumption (centered) were entered in Step 2, followed by the two-way

interaction terms between these variables in Step 3. Step 4 involved all three-way interaction terms, following by the four-way Dispositional Optimism x Message Valence x Argument Strength x Amount of Caffeine Consumption interaction entered at the last step. Regression slopes (simple slopes) and plots were calculated according to procedures outlined by Aiken and West (1991) for interpretation of interaction effects. Participants whose optimism scores were 1 *SD* below the mean were labeled as "low optimism," and those whose optimism scores were 1 *SD* above the mean were categorized as "high optimism."[1] The same criterion applied to categorizing high and low caffeine consumption.

Amount of caffeine use. Participants reported consuming an average of 1.85 servings of caffeinated drinks per day (*SD* = 1.20). The minimum reported consumption was a half serving and the maximum was 10 servings per day. We first examined whether the effects of the main predictors were moderated by differences in participants' baseline caffeine use. When the amount of caffeine consumption and its associated interactions were added to the regression analyses with the main predictors as described above, neither the main effect nor the interaction effects involving caffeine use was significant in predicting postmessage attitudes or intention. As a result, the caffeine use measure was excluded from further analysis.

Attitudes toward caffeine consumption. At baseline, participants reported somewhat negative attitudes toward caffeine consumption (*M* = 3.94, *SD* = 1.25), which were significantly below the midpoint of the scale (5, on the scale of 1 to 9; *t* (129) =

[1] Low dispositional optimists in Study 1 were those whose scores were equal to or lower than 3.03 on a scale from 1-5 of the LOT-R, whereas high dispositional optimists were those whose scores were equal to or greater than 4.49. Therefore, low optimists (i.e., pessimists) in this sample were those who indicated that they neither agreed nor disagreed with the items measuring optimism.

9.67, $p < .001$). Postmessage attitude was slightly more negative for the negative message condition ($M = 3.75$, $SD = 1.34$), and more positive for the positive message condition ($M = 4.92$, $SD = 1.13$).

When dispositional optimism, message valence, and argument strength were entered as predictors of attitude change (controlling for age, gender, and baseline attitudes), the regression analysis yielded three significant steps. As shown in Table 2, the main effects of age ($\beta = -.18$, $p < .05$) and baseline attitudes ($\beta = .48$, $p < .001$) were significant, $F(3,122) = 13.62$, $p < .001$, indicating that younger participants and those with more positive baseline attitudes toward caffeine use showed more favorable postmessage attitudes toward caffeine consumption. In Step 2, $\Delta R^2 = .26$, $\Delta F(3,119) = 20.94$, $p < .001$, there was a significant main effect of message valence ($\beta = .52$, $p < .001$), such that participants who read the positive message were more likely to show favorable postmessage attitudes toward caffeine consumption than those who read the negative message. There was also a significant main effect of argument strength ($\beta = -.13$, $p < .05$), indicating that exposure to the weak argument predicted more favorable postmessage attitudes toward caffeine use than exposure to the strong argument. Lastly, the third step of the analysis was significant, $\Delta R^2 = .05$, $\Delta F(3,116) = 4.78$, $p < .01$, and yielded a significant two-way Dispositional Optimism x Message Valence interaction ($\beta = .22$, $p < .01$). As shown in Figure 1, the relation of dispositional optimism to attitude change was significantly moderated by message valence. Specifically, dispositional optimism predicted marginally less favorable attitudes toward caffeine use among participants who read the passage about the negative effect of caffeine on heart valve function (slope = -0.33, $t(122) = -1.74$, $p = .084$). However, optimism was not

Table 2

Standardized Regression Coefficients (with ΔR^2) From Hierarchical Regression Analyses With Dispositional Optimism, Message Valence, and Argument Strength Predicting Postmessage Attitudes Toward and Intention to Change Caffeine Consumption.

Predictor	Attitude		Behavioral intention	
	ΔR^2	β	ΔR^2	β
Step 1	25***		.01	
Age		-.18*		-.02
Gender		.01		.10
Baseline attitude		.48***		-.08
Step 2	.26***		.38***	
Age		-.02		-.20
Gender		.03		.06
Baseline attitude		.56***		-.17*
Dispositional optimism		.02		.11
Message valence		.52***		-.61***
Argument strength		-.13*		.11
Step 3	.05**		.03	
Age		.01		-.21
Gender		.00		.08
Baseline attitude		.53***		-.15*
Dispositional optimism		-.17		.23^{+}
Message valence		.36***		-.46***
Argument strength		-.29***		.25*
Dispositional optimism x Message valence		.22**		-.10
Dispositional optimism x Argument strength		.06		-.06
Message valence x Argument strength		.26*		-.23^{+}
Step 4	.00		.00	
Age		.00		-.21**
Gender		.00		.08
Baseline attitude		.53***		-.15*
Dispositional optimism		-.20		.24
Message valence		.36***		-.46***
Argument strength		-.30***		.25*
Dispositional optimism x Message valence		.27*		-.12
Dispositional optimism x Argument strength		.11		-.09
Message valence x Argument strength		.26*		-.23^{+}
Dispositional optimism x Message valence x Argument strength		-.07		.03

Note. $^{+}p < .07$. $*p < .05$. $**p \leq .01$. $***p \leq .001$.

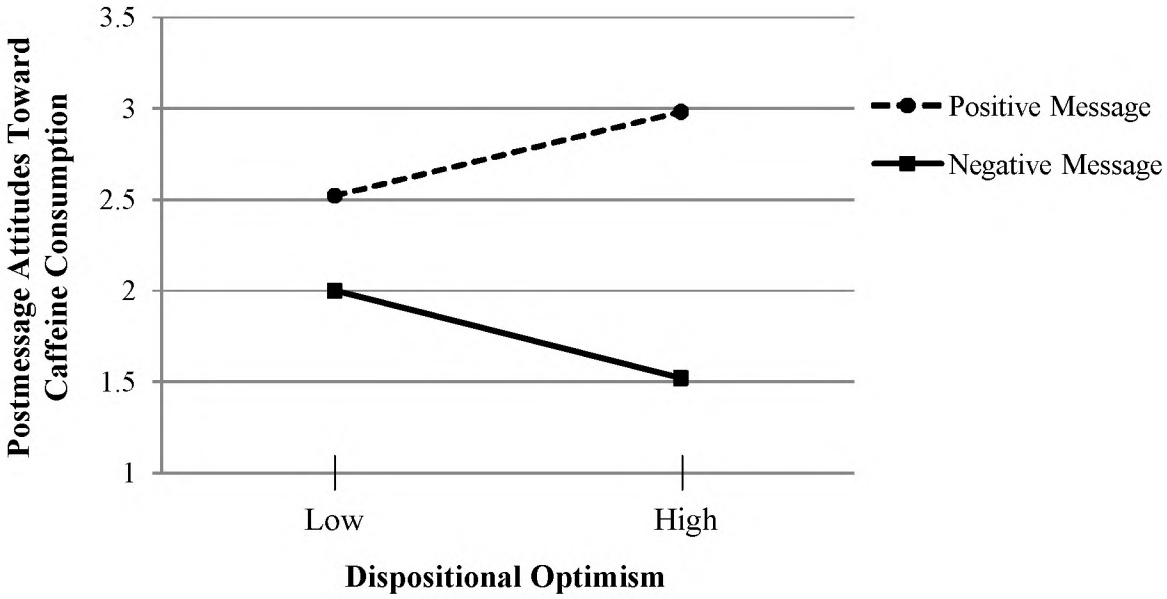


Figure 1. Relation of dispositional optimism to predicted postmessage attitudes toward caffeine consumption as a function of message valence, controlling for baseline attitude.

Note: Higher numbers indicate more favorable attitudes.

significantly related to more favorable postmessage attitudes toward caffeine consumption among participants who read about the positive effects of caffeine on heart valve function (slope = 0.41, t (122) = 1.45, $p < .16$). Interestingly, this interaction pattern is consistent with the valence-enhancement hypothesis, although it should be noted that neither of the slopes was significantly different from zero (the significant interaction result, however, indicated that the slopes were not parallel).

Intentions to change caffeine consumption. Participants' intentions to decrease (in the negative message condition) or increase (in the positive message condition) caffeine consumption in the next month were subjected to similar hierarchical regression analyses used for predicting attitude change (excluding baseline attitude). As shown in Table 2, a significant second step, $\Delta R^2 = .38$, ΔF (3,119) = 24.95, $p < .001$, indicated a highly significant main effect of message valence ($\beta = -.61$, $p < .001$), such that caffeine

consumers who read about the negative effects of caffeine consumption on heart valve function showed stronger intentions to reduce their caffeine consumption compared to caffeine consumers who read about the positive effects of caffeine. However, dispositional optimism did not predict intention to change caffeine consumption behavior, nor did it interact with other predictors in doing so. In summary, in predicting postmessage attitudes, the results were consistent with the valence-enhancement hypothesis such that dispositional optimism enhanced individuals' responses to the valence of the self-relevant persuasive message. We did not obtain evidence to support our hypothesis that optimism would facilitate differentiation between strong and weak arguments, as optimists did not appear to respond to the quality of the persuasive messages about health in making attitudinal judgments.

Cognitive and Affective Responses to the Persuasive Messages

Two independent raters coded the thoughts and feelings each participant listed in the thought-and-feeling listing tasks. First, a distinction between whether a particular response was cognitive or affective was made by two judges who were unaware of participants' experimental condition.

Affective responses were then categorized into three mutually exclusive categories: positive affective responses ("*I feel calm*"), negative affective responses ("*I'm worried about my risk [for heart valve malfunction]*"), and neutral feelings ("*surprised*"; see Appendix B for frequency of each category). Following Rosselli et al. (1995), who distinguished between cognitive and affective responses, a negative affective response

index was created by subtracting the number of positive affective responses from the number of negative affective responses of each participant.

Cognitive thoughts listed by participants were categorized into seven mutually exclusive categories: positive thoughts regarding caffeine use (e.g., "*I felt better about drinking coffee every morning*"), negative thoughts regarding caffeine use ("*Caffeine can only damage your body*"), thoughts supporting the message argument ("*I appreciated the mention that confounding variables were accounted for in the description of the study*"), thoughts criticizing the message argument ("*The sample groups were too small and biased to find any useful evidence*"), thoughts indicating defensive responses to the message such as denial or reactance ("*I didn't really want to believe the article because I consume at least two caffeinated beverages per day and would like for that not to affect my heart*"), thoughts indicating desire for further information ("*Wanting to learn more about how it is good for your health*"), and unrelated thoughts (see Appendix B for frequency of each category). Agreement between the two judges was 89.21%. Coding disagreements were resolved through discussion. Because optimism was expected to affect valence of cognitive responses (Geers et al., 2003), a proportion of negative thoughts about caffeine use index and a proportion of positive thoughts about caffeine use index were then created by dividing the number of each kind of thought by the number of total thoughts listed by each participant (Petty, Shumann, Richman, & Strathman, 1993).

It should be noted that the negative affective response index was not correlated with the proportion of negative thought about caffeine use index ($r = -.14$, $p > .05$) or with the proportion of positive thought about caffeine use index ($r = -.13$, $p > .05$). Each

of the cognitive and affective indices was then subjected to hierarchical regressions similar to those used in the primary analyses.

Proportion of negative thought about caffeine use index. The analysis revealed a significant main effect of baseline attitude (β = -.26, p < .01) in the first step, ΔR^2 = .09, ΔF (3,112) = 4.14, p < .01, such that more favorable baseline attitudes toward caffeine use predicted lower proportion of negative thoughts about caffeine use after reading the passage. In Step 2, ΔR^2 = .06, ΔF (3,119) = 2.75, p < .05, there was a main effect of message valence (β = -.19, p < .05), indicating that exposure to the negative message predicted greater proportion of negative thoughts about caffeine use. Interestingly, in Step 3, ΔR^2 = .13, ΔF (3,116) = 7.14, p < .001, there was a significant Dispositional Optimism x Message Valence interaction in the third step (β = -.41, p < .001). As shown in Figure 2, dispositional optimism significantly predicted a greater proportion of negative thoughts about caffeine use in response to the negative message (slope = 0.20, t (122) = 3.33, p < .002), but did not predict the proportion of such thoughts in response to the positive message (slope = -0.10, t (122) = -1.43, p < .16). These results indicated that dispositional optimists listed a greater proportion of negative thoughts about caffeine use after exposure to negative message, but did not differ from pessimists in the proportion of such thoughts following the positive message.

Proportion of positive thought about caffeine use index. The analyses yielded no significant results, indicating that dispositional optimism was not a significant predictor of the positivity of thoughts regarding caffeine use in response to either the positive or the negative message.

Negative affective response index. The analysis revealed a significant Step 2,

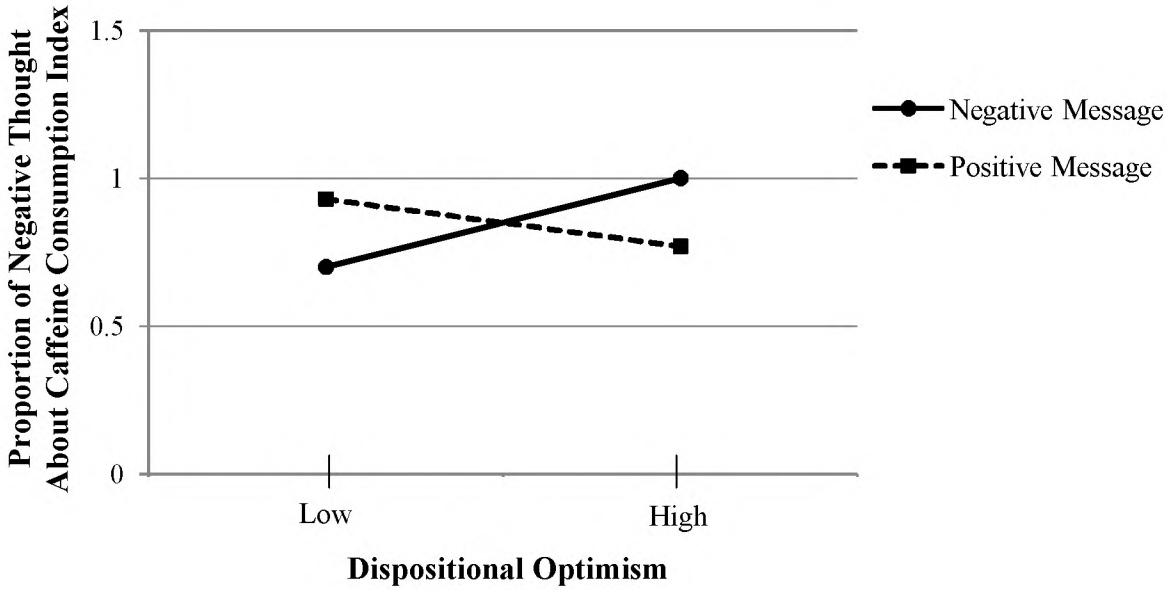


Figure 2. Relation of dispositional optimism to predicted proportion of negative thought about caffeine consumption index as a function of message valence.

Note. Higher numbers indicate greater proportion of negative thoughts.

$\Delta R^2 = .07$, $\Delta F\ (3,119) = 2.92$, $p < .05$, with a main effect of message valence ($\beta = -.26$, $p < .01$), indicating that negative message predicted greater negative affect. This effect, however, was qualified by a significant Dispositional Optimism x Message Valence interaction ($\beta = .24$, $p < .05$) in Step 3, $\Delta R^2 = .07$, $\Delta F\ (3,116) = 3.03$, $p < .05$. As depicted in Figure 3, dispositional optimism significantly predicted less negative affective responses to the negative message (slope = -1.11, $t\ (122) = -2.92$, $p < .003$), but did not predict negative affective responses to the positive message (slope = -0.12, $t < 1$). In sum, as we hypothesized, dispositional optimists showed a lower ratio of negative affect in response to the negative message, but were not different from pessimists in negative affect in response to the positive message.[2]

[2] Although we followed Roselli et al. (1995) in creating the negative affective response index, we tested whether the number of negative affective response alone (without subtraction of positive affective responses) yielded a similar outcome to the negative affective response index. The results indicated that

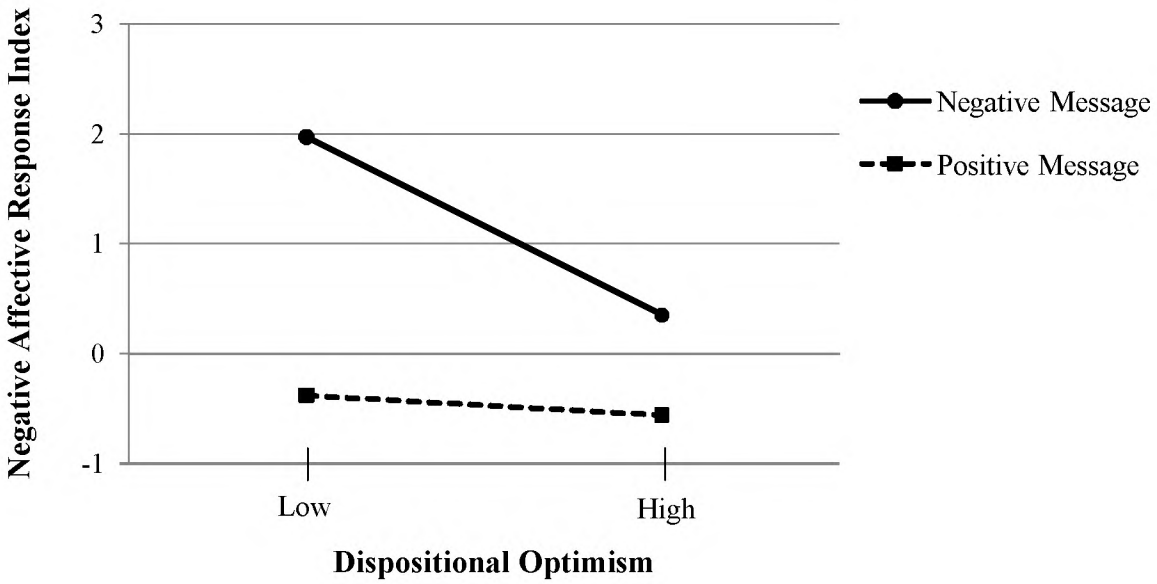


Figure 3. Relation of dispositional optimism to predicted negative affective response index as a function of message valence.

Mediation Analyses

The proportion of negative thoughts about caffeine use and the negative affective response indices were then used to test the prediction that not only cognitive, but also affective responses to the persuasive message would explain the moderating effects of optimism on attitude change. Mediated moderation analyses were performed using the bootstrapping procedure described by Preacher and Hayes (2008) for estimating direct and indirect effects with multiple mediators. The bootstrapping method involved repeatedly sampling from the data set, estimating the indirect effect of each mediator in each resampled data set, and constructing confidence intervals for the indirect effect. Postmessage attitudes toward caffeine use were entered as the outcome variable, the Dispositional Optimism x Message Valence interaction was entered as a predictor

---

number of negative affective responses yielded similar results. Specifically, dispositional optimists listed a lower number of negative affective responses to the negative messages (slope = -1.12, t (126) = -2.95, $p <$ .004), but did not differ from pessimists in listing negative affects in response to the positive messages (slope = -0.29, $t < 1$). Optimism, however, did not predict number of positive affective responses.

(controlling for dispositional optimism, message valence, and baseline attitudes), and the proportion of negative thought about caffeine use and the negative affective response indices were entered as potential mediators in the SPSS macro for multiple mediators created by Preacher and Hayes (http://www.comm.ohio-state.edu/ahayes/macros.htm). As shown in Table 3, bootstrap results based on 5,000 samples indicated, with 95% confidence, that the total indirect effect of Dispositional Optimism x Message Valence interaction on postmessage attitudes toward caffeine consumption through the two mediators (the sum of each specific indirect effect) was not significantly different from zero, with a point estimate of .02 (the bootstrap confidence interval is -.2027 to .2872 and thus contained zero). The direct effect of Dispositional Optimism x Message Valence interaction thus remained significant (unstandardized regression coefficient of direct effect = .63, $p < .05$). However, as discussed in Preacher and Hayes (2008), a significant total indirect effect is not required for testing specific indirect effects; therefore, the specific indirect effects through the proportion of negative thought and the negative affective response indices were examined next. The specific indirect effects of each proposed mediator indicated that both the proportion of negative thought index, with a point estimate of .1862 and a 95% bias-corrected and accelerated confidence interval (BCa 95% CI of .0335 to.4160), and the negative affective response index, with a point estimate of -.1626 and a BCa 95% CI of -.3447 to -.0347,[3] were significant unique mediators. A contrast test of the indirect effects showed that the specific indirect effect

[3] The mediation analysis using number of negative affective responses alone (without subtraction of positive affective responses) yielded similar results to the negative affective response index, such that number of negative affective responses significantly mediated the relationship between the Dispositional Optimism x Message Valence interaction on final attitudes toward caffeine use with a point estimate of -.1278 (BCa 95% CI of -.3233 to -.0314). The effect was also in the same direction as the negative affective response index.

Table 3

Multiple Mediation of the Effect of Dispositional Optimism x Message Valence Interaction on Postmessage Attitudes Toward Caffeine Consumption Through the Proportion of Negative Thought About Caffeine Consumption and the Negative Affective Response Indices.

	Point estimate	BCa 95% CI	
		Lower	Upper
Indirect effects			
Proportion of negative thought index	.1862	.0335	.4160
Negative affective response index	-.1626	-.3447	-.0347
Total	.0236	-.2027	.2872
Contrast			
Proportion of negative thought index vs. negative affective response index	.3488	.1322	.6278

Note: Bootstrap was based on 5,000 samples. $N = 126$. BCa 95% CI = 95% bias-corrected and accelerated confidence interval. Confidence intervals not including 0 indicate significant results.

through the proportion of negative thoughts index was larger than that through the negative affective response index, with a BCa 95% CI of .1322 to .6278. The overall model that included both the predictor (Dispositional Optimism x Message Valence) and the two mediators (the proportion of negative thought and the negative affective response indices) in predicting postmessage attitudes toward caffeine consumption was significant, $R^2 = .58$, $F(6,119) = 26.94$, $p < .001$.

To summarize, the mediation analyses demonstrated that compared to pessimists, dispositional optimists' less favorable attitudes toward caffeine use after exposure to a message about the harmful effects of caffeine were based on the proportion of negative thoughts about caffeine use and negative affect in response to the persuasive message, such that a higher proportion of negative thoughts and greater negative affective response predicted less favorable attitudes toward caffeine use. Interestingly, these two mediational pathways operated in different directions in predicting optimists' resulting

attitudes. First, optimists listed fewer negative affective responses after exposure to the message about the harmful effects of caffeine use, and fewer negative affective responses predicted more favorable attitudes toward caffeine use. However, optimists generated a greater number of negative thoughts concerning caffeine use, and this greater proportion of negative thoughts predicted less favorable attitudes toward caffeine consumption. Although these two effects were in opposing directions, the effect size of the proportion of negative thoughts about caffeine use was greater than that of the negative affective response. Optimists' attitudes toward caffeine use thus were more determined by their negative thoughts about caffeine, than by their negative affective responses. Consequently, optimists showed somewhat less favorable attitudes toward caffeine use as compared to pessimists following a negative message. These findings supported our hypothesis that affective responses, in this case negative ones, to persuasive messages regarding health risks mediated the interactive effect of optimism and message valence in predicting postmessage attitude independently from the mediating effect of cognitive response.

Extensiveness of Message Processing

It was hypothesized that optimists would benefit from their positive outcome expectancies and be more likely to process the threatening persuasive message carefully and less defensively. In addition to the cognitive elaboration indices from the open-ended measure of the thought-and-feeling listing tasks, participants' ratings of their own cognitive effort and the judges' evaluation of participants' message elaboration were examined as indicators of optimists' extensiveness of message processing.

Self-rating of cognitive effort. In general, participants reported putting high effort into processing the passage (M = 7.12, SD = 1.51, on a scale from 1 to 9). Participants' rating of their degree of cognitive effort used in thinking about the content of the medical report was subjected to primary hierarchical regression analyses. The results revealed a marginally significant second step, ΔR^2 = .06, ΔF (3,119) = 2.46, p = .066, containing a main effect of dispositional optimism (β = .22, p < .05). These results suggested that optimists reported greater effort in thinking about and trying to understand the passage describing the health-related consequences of caffeine consumption than did pessimists, regardless of the valence and argument strength of the message to which they were exposed.

Objective rating of message scrutiny. Overall, participants were rated as showing relatively low elaboration when processing the medical report (M = 4.25, SD = 1.69, on a scale from 1 to 10). The agreement of the two judges was 85.38%, with scores that were within one point or less of each other considered as agreeing. As shown in Figure 4, when the objective evaluation of participants' message scrutiny was subjected to the primary hierarchical regression analyses (controlling for baseline attitude), there was a marginally significant Step 2, ΔR^2 = .06, ΔF (3,116) = 2.55, p = .059, containing a significant Dispositional Optimism x Message Valence interaction (β = -.28, p < .05), indicating that dispositional optimists elaborated on the negative message to a greater extent than did their pessimistic counterparts (slope = 0.92, t (122) = 2.63, p < .01), but did not differ from the pessimists in their elaboration on the positive messages (slope = -0.11, t < 1). No other significant results were observed. Overall, the results from three indicators -- cognitive responses from the thought- and-feeling listing tasks, self-reports

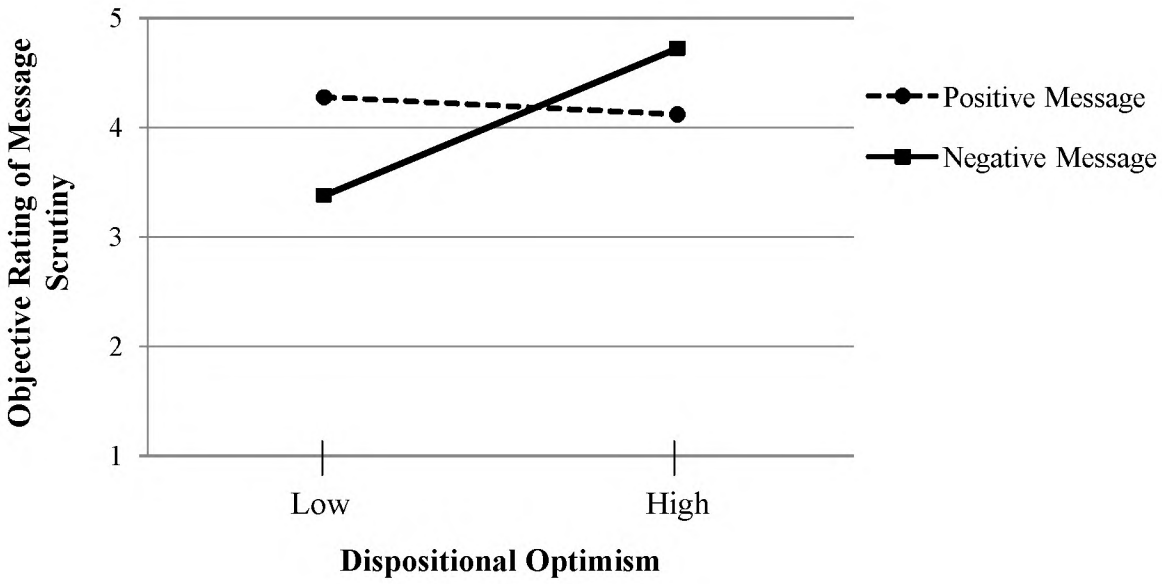


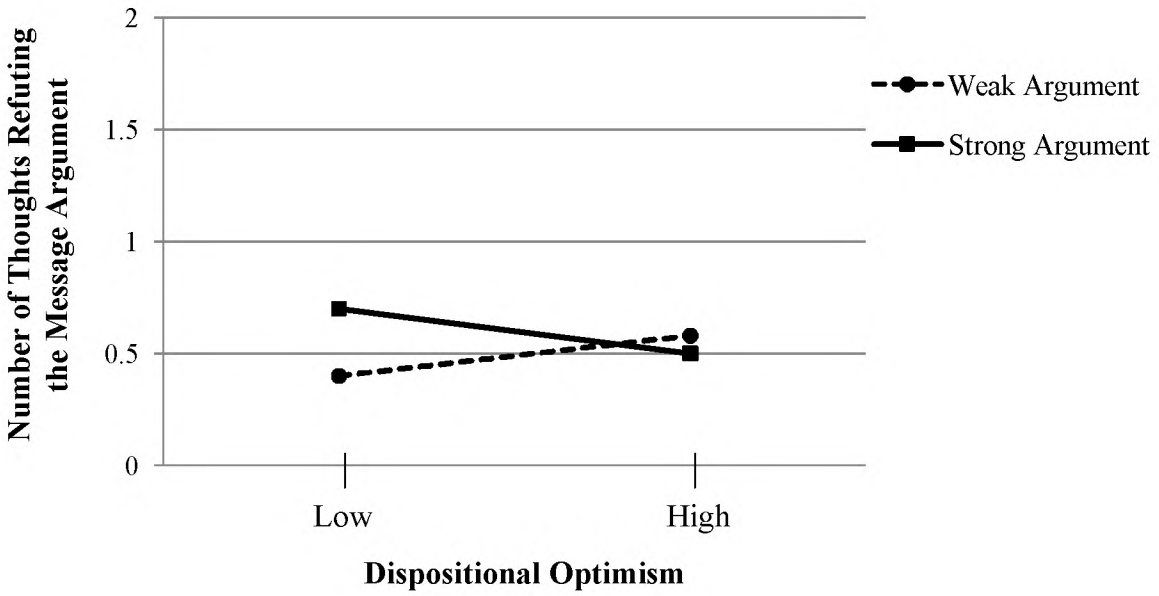
Figure 4. Relation of dispositional optimism to predicted objective rating of message elaboration as a function of message valence.

Note: Higher numbers indicate greater message elaboration on a scale of 1 to 10.

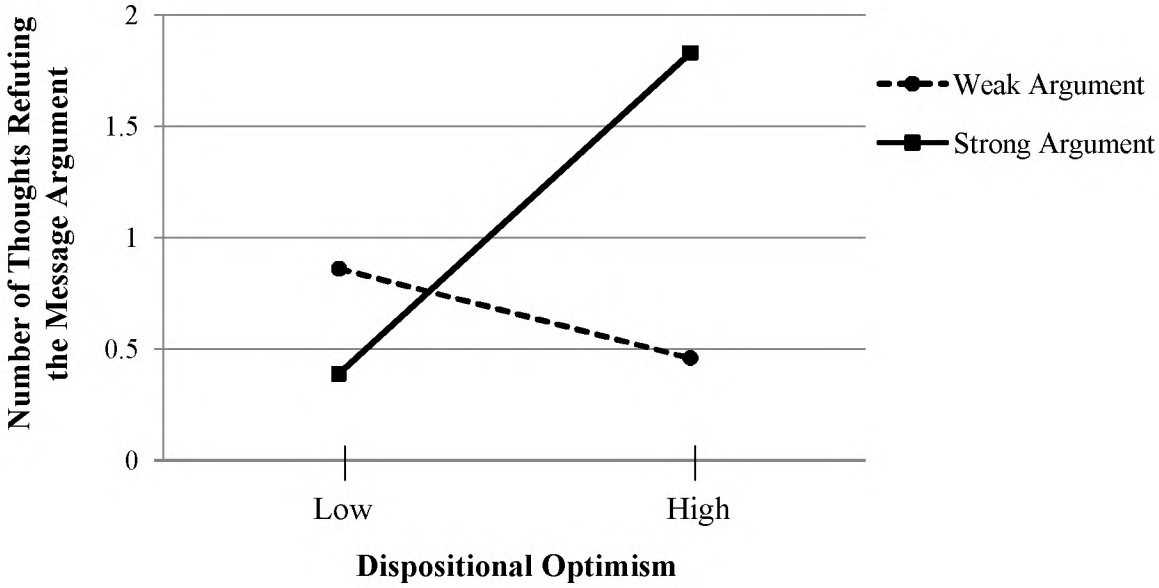
of cognitive effort, and judges' ratings of message elaboration -- were consistent in indicating that optimists effortfully processed the message, especially the negative one, to a greater extent than did pessimists.

Additional Analyses on Other Thought Indices

We tested whether optimism was associated with any of the other indices derived from the thought-and-feeling listing tasks using the same hierarchical regression analysis as the primary one. The thought indices tested here were not part of the proportion of negative thought about caffeine use index used in the mediation analyses (See examples of thoughts for each category in Appendix B). We obtained a significant result in predicting number of thoughts criticizing the message argument about the effects of caffeine use. As shown in Figure 5, after controlling for baseline attitude, in the last step



a. Negative message condition.



b. Positive message condition.

Figure 5. Relation of dispositional optimism to predicted number of thoughts refuting the message argument, as a function of argument strength, in the negative and positive message conditions.

Note: Higher numbers indicate greater number of thoughts.

of the analysis, $\Delta R^2 = .06$, $\Delta F\,(1,115) = 7.69$, $p < .01$, there was a significant three-way Dispositional Optimism x Message Valence x Argument Strength interaction ($\beta = .42$, $p < .01$) in predicting number of thoughts refuting the research evidence cited in the persuasive messages, such that dispositional optimism significantly predicted greater number of the thoughts criticizing the strong (slope = 0.99, $t\,(118) = 3.09$, $p < .003$), but not the weak positive message (slope = -0.26, $t\,(118) = -1.00$, $p < .32$). Dispositional optimism did not predict number of thoughts refuting the weak (slope = 0.12, $t < 1$) or strong evidence (slope = -0.14, $t < 1$) cited in the negative message. To summarize, instead of showing greater message acceptance, optimists were more likely than pessimists to question the validity of the strong evidence that provided support for the healthfulness of their current behavior.

Tests of Confounding Effects of Other Individual Differences

Neuroticism, trait self-esteem, self-mastery, and trait positive affectivity. To examine whether other individual differences known to be correlated with dispositional optimism were responsible for the predictive effects obtained for attitudes and behavioral intentions, each individual difference and its interaction terms were added to the primary hierarchical regression analyses as simultaneous predictors with dispositional optimism in predicting postmessage attitude toward caffeine use. With neuroticism, self-mastery, trait self-esteem, or trait positive affectivity in the equations, the Dispositional Optimism x Message Valence effect remained significant and virtually equivalent in magnitude in

all analyses, suggesting that these individual differences did not confound the effects of dispositional optimism reported in the primary analyses.[4]

Naïve optimism. Unlike the other individual differences, when the effects of naïve optimism were statistically controlled, the patterns of the moderating effects of dispositional optimism on postmessage attitudes toward caffeine use were altered. Specifically, when naïve optimism was added to the model as a simultaneous predictor, the Dispositional Optimism x Message Valence interaction in predicting postmessage attitudes toward caffeine use became nonsignificant (dropping from $\beta = .22$, $p < .01$to $\beta = .13$, $p < .19$). However, the Dispositional Optimism x Argument Strength interaction instead became significant ($\beta = .23$, $p < .05$). As shown in Figure 6, with naïve optimism in the same model, dispositional optimism significantly predicted less favorable attitudes toward caffeine consumption following the weak (slope = -.38, t (122) = -2.00, $p < .05$), but not strong argument (slope = 0.27, t (122) = 1.23, $p < .23$). Interestingly, the Naïve Optimism x Message Valence ($\beta = .22$, $p < .05$) and Naïve Optimism x Argument Strength ($\beta = -.32$, $p = .001$) interactions were also significant. Simple slope testing, shown in Figures 7 and 8, indicated that naïve optimism predicted more favorable attitudes toward caffeine consumption following the positive message (slope = .96, t (126) = 2.67, $p < .01$), but did not predict such attitudes following the negative message (slope = .09, t <1). In addition, naïve optimism predicted significantly less favorable attitudes toward caffeine consumption when the message was strong (slope = -1.28, t (126) = -3.56, $p < .001$), but not when it was weak (slope = .09, t <1).

---

[4] When each individual difference was considered as a predictor of postmessage attitudes toward caffeine consumption (with dispositional optimism in the same model), there was a significant main effect of neuroticism ($\beta = .17$, $p < .05$), such that higher neuroticism predicted more favorable postmessage attitudes toward caffeine use. There were no significant interactions involving neuroticism. No other significant effects were obtained for any of the other predictors.

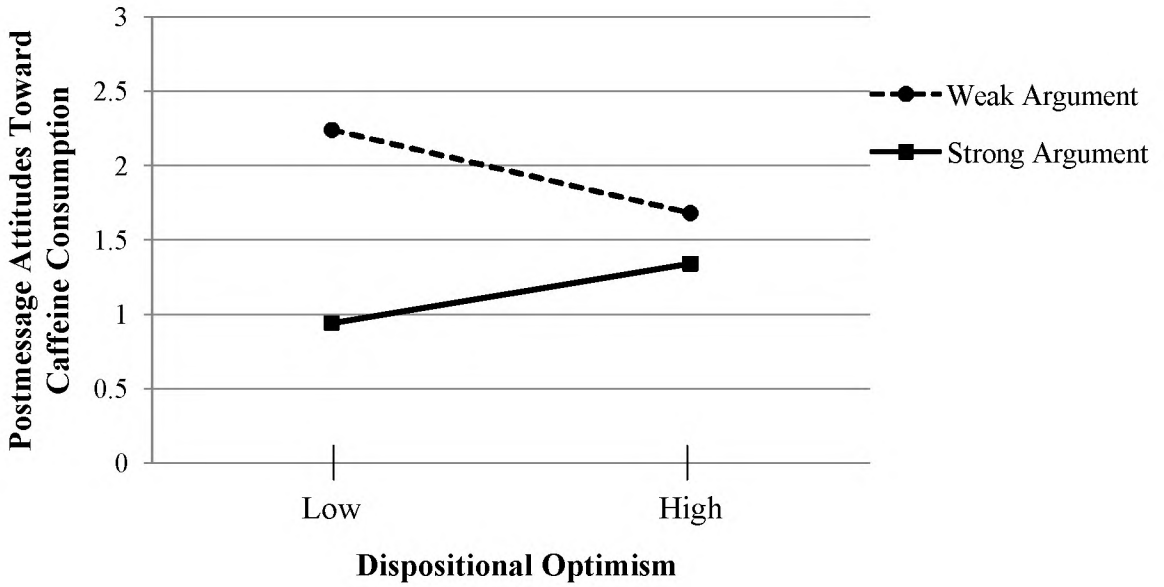


Figure 6. Relation of dispositional optimism to predicted postmessage attitudes toward caffeine consumption, as a function of argument strength, with naïve optimism as a simultaneous predictor.

Note: Higher numbers indicate greater favorable attitudes.

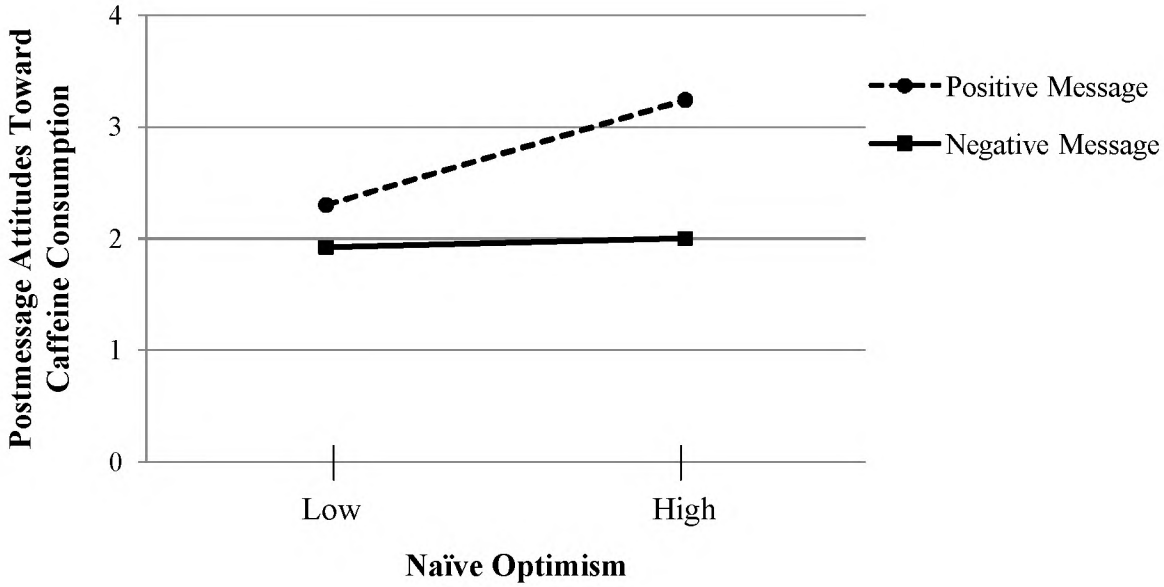


Figure 7. Relation of naïve optimism to predicted postmessage attitudes toward caffeine consumption as a function of message valence with dispositional optimism as a simultaneous predictor.

Note: Higher numbers indicate greater favorable attitudes.

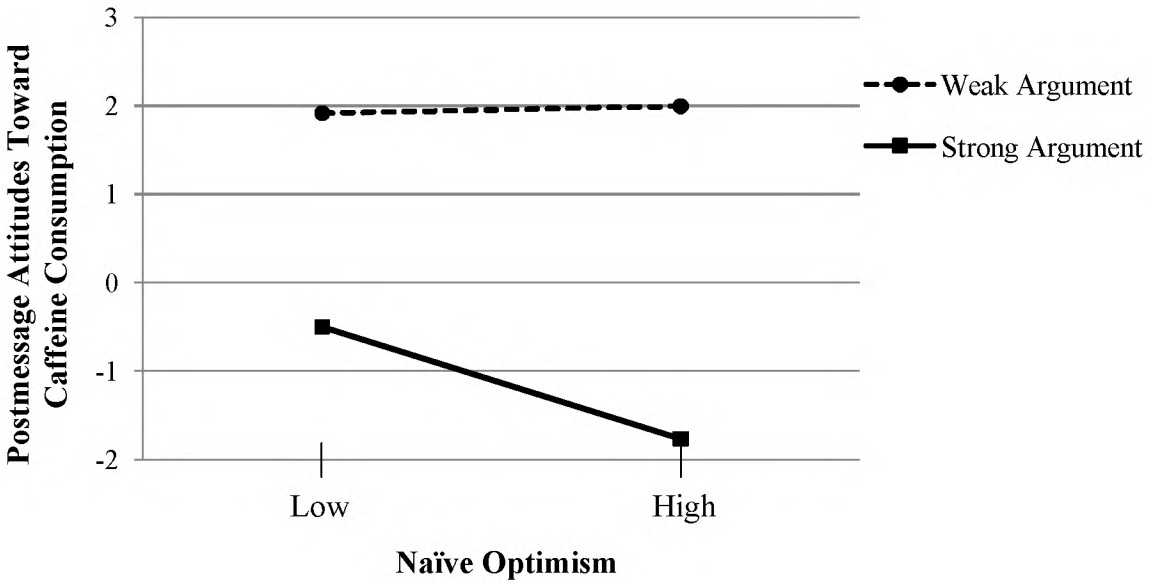


Figure 8. Relation of naïve optimism to predicted postmessage attitudes toward caffeine consumption as a function of argument strength with dispositional optimism as a simultaneous predictor.

Note: Higher numbers indicate greater favorable attitudes.

To summarize, with naïve optimism and its interactions in the same model, the effect of Dispositional Optimism x Message Valence became nonsignificant, while the Dispositional Optimism x Argument Strength interaction became significant such that optimists showed less favorable attitudes toward caffeine use when the message was weak. Two interactions involving naïve optimism were significant indicating that naïve optimists showed more favorable attitudes toward caffeine use when the message presented the benefits of caffeine, but showed less favorable attitudes when the message was supported by strong evidence. Therefore, although naïve optimism was significant in predicting postmessage attitudes toward caffeine use, it did not show the same pattern of results as dispositional optimism.

Discussion

Study 1 was designed to test competing hypotheses about the relation of dispositional optimism to the processing of valenced health messages. If the valence-enhancement hypothesis (Geers et al., 2003) held true, optimists would respond to the valence of persuasive message to a greater extent than would pessimists. However, we argued that optimism may act as a personal resource in processing threatening information, and thus the effects of optimism would be stronger among participants exposed to a negative persuasive message than among those exposed to a positive message. Study 1 provided partial support to both the valence-enhancement and our hypotheses. We believe that optimists may alter their attitudes in a way that increases the likelihood of positive future outcomes and/or minimizes negative future outcomes.

Optimism Fosters Less Negative Affective and More Negative Cognitive Responses to Self-relevant Health-threatening Information

As hypothesized, we found that optimists who regularly consumed caffeinated drinks responded to health-threatening information about caffeine use with less negative emotional responses (e.g., worried, anxious, frustrated), but were not different from pessimists in responding to the health-encouraging message. These results were consistent with Kaiser et al. (2004) who demonstrated that optimists adjusted to threatening information about prejudice against their own gender better than pessimists by showing less negative affect afterwards. Thus, the finding concerning optimists' less negative affective responses to health-threatening persuasive messages aligns with our

idea that optimistic beliefs acted as personal resources for individuals in handling threatening information.

We hypothesized that optimists would process the self-relevant health-threatening persuasive message carefully, resulting in differentiation among strong and weak arguments. However, our results suggest that optimists' postmessage attitudes toward caffeine consumption did not depend on the quality of persuasive messages, but they were influenced by the valence of the messages, as predicted by the valence-enhancement hypothesis (Geers et al., 2003). Particularly, we found that dispositional optimists' final attitudes toward caffeine consumption were not influenced by the strength of the message. We, therefore, did not obtain the differentiation of strong and weak arguments which was hypothesized to be a result of optimists' careful processing of health-threatening persuasive messages.

An important question is whether optimists' failure to differentiate between strong and weak arguments indicates their superficial processing of self-relevant persuasive messages. The other findings from Study 1 strongly suggested otherwise. Specifically, optimists demonstrated greater cognitive elaboration of the persuasive message than did pessimists, especially of the negative message, as evidenced by three different indicators: cognitive response analysis on the thought-and-feeling listing tasks, self-report of cognitive effort in message processing, and the judges' evaluation of participants' message scrutiny. Study 1, therefore, reported strong evidence consistent with previous research (Aspinwall & Brunhart, 2000; Aspinwall et al., 2001) that optimism was associated with extensive processing of self-relevant threatening information. Thus, failure to respond to the strength of the arguments is not due to shallow processing of the

messages, but possibly is a result of optimists' greater responsiveness to message valence in making attitudinal judgments.

Taken together, these findings supported our main idea that optimistic beliefs promote adaptive responses to information that challenges people's current health behavior, as indicated by fewer negative feelings and greater cognitive elaboration of the information, as well as attitude change in the direction that would decrease negative future health outcomes.

Optimists' Cautious Evaluation of Self-relevant Positive Persuasive Messages

Our results provide some support for the valence-enhancement hypothesis -- dispositional optimism promotes somewhat enhanced negative attitudes toward caffeine use following a persuasive message about its significant harmful effects on cardiac function. However, unlike Geers and colleagues, we did not obtain enhancing effects of optimism on final attitudes toward caffeine use following positive messages. While this result concurs with our prediction that the beneficial role of optimistic beliefs in facilitating adaptive coping would be evident when individuals face threatening, but not favorable information, this result should be carefully considered due to the apparent limited effectiveness of the positive message manipulation. Participants rated the positive message as generally weaker than the negative one, possibly because the positive message went against their previous knowledge regarding health-compromising consequences of caffeine use. Although the positive message presented a new benefit of caffeine use that might justify participants' caffeine consumption, the benefit did not

cancel the known harmful effects associated with regular consumption (e.g., caffeine addiction). Therefore, it is likely that the positive message was evaluated with the harms of caffeine use in mind. Below are examples of cognitive responses to the positive message about benefit of caffeine use from participants (regardless of their optimism level).

> Example 1: "I was surprised that caffeine might have some benefits, because it's not something I've ever heard/considered before. (I) had to reread the statement a couple times to make sure I wasn't misreading it, because all that is ever mentioned is how bad it is for you."

> Example 2: "I was somewhat skeptical about the caffeine research. My belief is that caffeine can cause more harm on human body than good. Conventional wisdom is that caffeine is an addictive drug that can cause unpleasant withdrawal symptoms."

At least to some extent, participants evaluated the positive message encouraging caffeine use as weaker than the negative message because the positive message contradicted their knowledge about the negative effects of caffeine. The results of Study 1 regarding the positive message, therefore, cannot be concluded to be inconsistent with the valence-enhancement hypothesis, but also cannot be considered to be strong evidence supporting our hypothesis that the role of optimism would not be evidenced when people processed positive information.

Interestingly, we found that optimists were critical in their processing of the positive message by listing more thoughts questioning the validity of the strong research evidence that suggested the benefits of caffeine use than did pessimists, possibly because the message did not adequately acknowledge the harms of caffeine. The tendency for optimists to take into account both positive and negative outcomes of caffeine use in making a judgment of whether to accept the positive message suggests that optimists look

carefully at the possibilities of both negative and positive health outcomes of caffeine use. Rather than responding only to valence of the message (positive) as suggested by the valence-enhancement hypothesis, optimists in the positive message condition seemingly responded to the overall valence of the likely outcomes of caffeine consumption (both positive and negative). This observation suggests that optimistic beliefs might moderate attitude change via enhanced responsiveness to likelihood of experiencing positive and negative future outcomes associated with practicing a recommended health behavior.

The idea of optimists' enhanced responsiveness to the valence of possible outcomes of accepting an attitude object could explain the inconsistency between our results and those of Geers et al. (2003) study that documented the enhancing effect of dispositional optimism on attitude change following positive messages. Optimists (and pessimists) in Geers and colleagues' study were exposed to novel attitude objects. Without pre-existing knowledge to verify the likelihood of attaining negative and positive outcomes of accepting or rejecting the attitude objects, their attitudes thus were influenced by the valenced persuasive message as the most salient source of information regarding valence of future outcomes.

To summarize, optimists in Study 1 seemed to evaluate positive persuasive messages cautiously. They were more likely than pessimists to counterargue strong evidence supporting such messages, possibly because the positive message did not adequately take into account the likelihood of negative outcomes associated with the behavior recommended as beneficial.

Cognitive and Affective Mediators of Optimism's Moderation of Processing of Health Risks and Benefits

The moderating effects of optimism on postmessage attitudes were hypothesized to occur not only through cognitive, but also affective responses to the persuasive messages. As predicted, we found that cognitive responses to the persuasive messages, namely, negativity of thoughts concerning caffeine use, explained the relationship between dispositional optimism's moderation of message valence and final attitudes toward caffeine use. Optimists generated a greater proportion of anti-caffeine thoughts following the negative message than did pessimists, and such negativity of thought significantly predicted more negative subsequent attitudes toward caffeine use. Importantly, negative affective responses to self-relevant, health persuasive information were also a significant mediator of the relationship, such that dispositional optimists listed fewer negative affective responses to the negative messages than did pessimists. The less negative feelings, however, contributed to more positive attitudes toward caffeine use. Although the two mediators of optimism's moderation of attitude change worked against each other, we found that the anticaffeine thoughts had a stronger effect on final attitudes toward caffeine use than the negative affective response. Thus, though optimists' less negative feelings might inform them that the health-threatening effect of caffeinated drinks was not too bad (which might be true, e.g., if used in moderation), optimists did not reject and even elaborated on the information concerning serious harmful effects of caffeine use in making attitudinal judgments about caffeine consumption. As a result, optimists' attitudes toward the health threat were altered in a way that would promote the prevention of harmful outcomes. Therefore, in line with

previous studies that highlighted the important role of affective responses in the attitude change process (Rosselli et al., 1995; Zuwerink & Devine, 1996), Study 1 extended previous research by providing the first evidence that both cognitive and affective responses to self-relevant health-related persuasive messages explain the role of optimism on attitude change in response to negatively valenced messages, albeit in opposing directions.

Implications for Optimism Research

The findings of Study 1 demonstrated a significant role of dispositional optimism on persuasion processes and outcomes regarding self-relevant health behavior. The findings that optimism was associated with greater elaboration of and fewer negative affective responses to a threatening persuasive message aligned with our hypothesis that optimism was associated with greater personal resources to cope with self-threatening information (Chang, 1998; Kaiser et al., 2004; Peacock & Wong, 1996). The finding that optimists changed their attitudes in a way that would be beneficial to their health, however, still needs a specific explanation. We propose that optimism is associated with increased vigilance to information about the valence of outcomes compared to other features of a persuasive message (e.g., strength of argument). Optimists might consider the likelihood of attaining negative and positive outcomes associated with the behavior in question, and alter their attitudes in a way that increases the likelihood of attaining favorable future outcomes and decreases the likelihood of experiencing unfavorable future outcomes. According to this idea, because caffeine use is known to have some negative consequences, using caffeine for the benefit of heart health is unlikely to yield

unequivocally positive future outcomes. Optimists thus did not increase positive attitudes toward caffeine use following the positive message.

Strengths and Potential Limitations of Study 1

Study 1 possesses some strengths in examining the moderating role of optimism in attitude change processes and outcomes. First, it replicated and extended previous research by demonstrating the role of dispositional optimism in attitude change. Study 1 also measured three different indicators of cognitive elaboration, namely, the thought-and-feeling listing tasks, self-rating of cognitive effort, and judges' rating of cognitive elaboration, and thus provided strong evidence regarding optimists' extensive elaboration of a negative persuasive message about health risks. Importantly, for the first time, we investigated an affective pathway through which optimism moderates the effects of message valence on attitude change. To confidently conclude that the observed pattern of results is unique to optimism, we provided tests for confounding effects of five individual differences related to optimism, namely, neuroticism, self-mastery, trait self-esteem, positive-trait affectivity, and naïve optimism, and none of these were found to account for the pattern of results.

The present study mirrored several important aspects of the real-world experience of persuasion by exposing people with initial attitudes toward their own health behavior to persuasive messages that were similar to health information generally available via the Internet or health magazines. With rather high external validity in regard to the characteristics of message content, we believe that the findings could be generalized to responses to persuasive communications regarding other similar health behaviors that

people generally hold moderately negative attitudes toward, such as marijuana use (Simons & Carey, 1998).

The current study also possesses some potential limitations. As mentioned earlier, our positive message was rated by participants as less convincing than the negative one. Although the weakness in the positive message manipulation could pose a threat to internal validity of Study 1 (that we did not obtain significant results using optimism and argument strength to predict attitude and intention in the positive message condition), participants' evaluation of the positive message might represent actual responses to such information in real settings when people face a persuasive message that is inconsistent with their existing knowledge (even though it may be consistent with their current behavior). Nevertheless, it will be important in future research to improve the operationalization of positive messages about the health-promoting effects of one's own health behavior to more fully test the relation of optimism to responses to such messages.

STUDY 2: OPTIMISM AND PROCESSING OF FEAR-AROUSING MESSAGE AND ACTION RECOMMENDATION

To further test whether optimism promoted less defensive processing in dealing with threatening information, Study 2 replicated and extended Study 1 in several ways. First, Study 2 adopted the fear appeal paradigm to examine whether optimism facilitated coping with self-relevant fear-arousing information by experimentally manipulating individuals' risk of a serious health problem. A significant health threat should elicit more defensive responses from individuals who are at high risk than from those at low risk. Second, Study 2 examined whether optimistic belief promoted less defensive processing of persuasive messages by manipulating the stated effectiveness of an action recommendation (i.e., response efficacy) following fear-arousing information about a health threat. If optimistic beliefs decreased positive bias (a manifestation of defense motivation after exposure to fear appeals characterized by overly positive evaluation of a recommended action; Das et al., 2003; de Hoog et al., 2005) in evaluating an action recommendation, optimists at risk for a health threat should show increased differentiation among different levels of response efficacy, as well as enhanced positive attitudes toward the highly effective and enhanced negative attitudes toward the ineffective training. However, if optimism increased outcome valence-focused processing, optimism should only enhance positive attitudes toward the highly effective action recommendation, as this recommendation was clearly associated with positive

outcomes in averting the threat. Third, Study 2 aimed to investigate how optimistic beliefs influenced cognitive and affective responses to both fear-arousing information and action recommendations. Use of a persuasion strategy focused primarily on eliciting (negative) emotional responses, such as a fear appeal, provided another test of the role of affective responses to persuasive messages in mediating the effects of optimistic beliefs on attitude change observed in Study 1.

Study 2, therefore, supplemented Study 1 by testing the role of optimism in response to health-threatening information. It also extended Study 1, in which vulnerability was measured in terms of daily caffeine consumption, by experimentally varying individuals' chance of experiencing future negative outcomes from a health threat (i.e., risk). It should be noted that, similar to Study 1, severity of the health threat was held constant at a high level in all conditions. Further, Study 2 specifically tested the influences of optimistic beliefs on attitudinal judgments regarding positive persuasive messages (i.e., information concerning positive outcomes of a health-prevention behavior), which had been unclear from Study 1 findings.

Hypotheses

Optimistic beliefs were expected to assist individuals in dealing with threatening information. As a result, optimists at high risk for a serious health threat should show less negative affective responses to fear-arousing information as compared to pessimists. In line with the results of Study 1 regarding optimism's moderating effects on attitude change, we also predicted that optimism would promote outcome valence-focused processing, such that optimists at high risk for a health threat would show greater positive

feelings, thoughts, and attitudes toward the highly effective action recommendation, but not the moderate and low efficacy training, as compared to pessimists. The positive feelings and thoughts regarding the highly effective recommendation were hypothesized to explain moderating effect of optimism on attitude toward the action recommendation. For optimists whose risk for the health threat was low, however, positive outcomes associated with the highly effective action recommendation would have low impact. As a result, optimists' attitudes toward the highly effective action recommendation would not differ from pessimists'.

Methods

Participants

Participants were 124 undergraduate students from the University of Utah recruited through the Psychology Department undergraduate participant pool. All participants received partial course credit for their participation.

Design

This study employed a dispositional optimism (continuous measure) x 2 (risk for repetitive strain injury: high versus low) x 3 (response efficacy of the recommended treatment program: high, moderate, and low) between-subjects design. Participants were randomly assigned to one of these six cells.

Procedure

Upon arrival at the laboratory, participants were told that the study, conducted in conjunction with the Student Health Services of the University of Utah, involved a survey of college students in an attempt to raise students' awareness of some important health issues. Study 2 used repetitive strain injury (RSI), a disorder occurring when movable parts of the limbs, especially hands and wrists, are injured due to excessive and/or repetitive use of limbs and sustained or awkward positions. Although RSI is an actual health problem, it is not a well-known one among young adults, probably due to the fact that its effects are more pervasive among adult workers. To convince participants that RSI was a real health problem, posters that briefly described RSI and encouraged taking an RSI diagnostic test at the Student Health Services were posted on the laboratory wall close to where participants were seated. Participants were first asked to complete computerized measures of individual differences similar to Study 1, including the measures of dispositional optimism and a brief health survey that included a fictitious diagnostic test assessing participants' risk for developing RSI. Next, participants were asked to read an RSI information sheet that presented a fear-arousing message about RSI while the experimenter went into another room nearby to print their RSI diagnosis results. Participants then received false feedback on their responses to the fictitious RSI diagnosis test indicating either that they were at risk or not at risk for developing RSI. After that, participants were asked to read a one-page flyer describing a (fictitious) free-of-charge RSI-prevention training provided by the university. In the message, the effectiveness of the program was manipulated to be high, moderate, or low. Next, participants' attitudes and intention were measured. Participants were then

presented with an opportunity to reserve a seat in the training and subscribe to a biweekly email newsletter concerning prevention of RSI. Participants' cognitive and affective responses toward the fear-arousing information about RSI and the training recommendation were next assessed on the open-ended, thought-and-feeling listing tasks used in Study 1. Finally, manipulation check questions were administered. Participants then were carefully debriefed and thanked for their participation.

Measures and Materials

Measures of Optimism and Other Individual Differences

Dispositional optimism. The LOT-R (Scheier et al., 1994) was again used to assess dispositional optimism (α = .72).

Individual differences related to optimism. Four additional personality constructs, namely, neuroticism (Costa & McCrae, 1992; α = .84), self-mastery (Pearlin & Schooler, 1978; α = .81), trait positive affectivity (Watson & Clark, 1994; α = .88), and trait self-esteem (Rosenberg, 1965; α = .90) were measured using the same scales as in Study 1.

Manipulations of Predictors

Risk for RSI. To manipulate risk for RSI, participants were first asked to fill out a computerized health survey assessing regular engagement in activities that involved repetitive movements and high stress level and the presence of symptoms of pre-RSI. Next, the experimenter informed participants that the health survey they filled out was actually a RSI diagnostic test provided by the Student Health Services and that their responses on the health survey were being processed by a computer in a nearby room.

While waiting for the diagnostic results to be printed, participants were asked to complete computerized personality measures. The experimenter left the laboratory for about 5 minutes and came back with fictitious RSI diagnostic results. The experimenter first asked participants to read a 440-word information sheet describing symptoms and severe negative consequences of RSI, such as feelings of paralysis, inflammation of tendons, nerve damage, and incapacity of limbs. RSI was presented as a new health threat to college students due to activities such as frequent computer use, texting, and playing videogames (see Appendix C for the complete text). Participants then received false RSI diagnostic results that indicated that they were either "at risk of repetitive strain injury" based on "repetitive uses of limbs/signs of pre-RSI" (high-risk condition) or "not at risk of repetitive strain injury" based on "no serious repetitive or overuse of limbs/no sign of RSI" (low-risk condition; see Appendix D for the complete text). Thus, to manipulate RSI risk, we presented two kinds of risk information to participants--information about increasing prevalence of RSI among college students and false feedback regarding personal risk. For the high-risk manipulation, therefore, participants were told that they and their group were at risk for RSI. For the low-risk manipulation, participants were told that their group, but not themselves, were at risk for RSI.

Response efficacy of the RSI-prevention training. Orthogonal to the risk manipulation, participants were assigned to one of three conditions manipulating the response efficacy of a potential intervention to prevent RSI (training). These conditions were manipulated in the following manner: Participants were told that the program had been tested at different universities, and that it was found to be very successful, as 88% of students who participated in the training showed decreased risk of RSI after participation

(high response-efficacy condition), that the program was moderately successful, as 50% of students showed decreased RSI risk after participation (moderate response-efficacy condition), or that the program was slightly successful, as only 12% of students showed decreased RSI risk after participation (low response-efficacy condition; see Appendix E for the complete text).

Main Outcomes

Attitudes toward the RSI-prevention training. Participants' attitudes toward the RSI-prevention training was assessed by their rating of how good, important, and interesting they thought the training was, and how much they liked the training on a scale from 1 *(not at all)* to 9 *(very much)*. Responses from all four items (α = .86) were averaged to create an index of favorable attitudes toward the training.

Intention to participate in the RSI-prevention training. Following the attitude measures, participants were asked to indicate if they should, will, are going to, and are interested in participating in the RSI-prevention training on a scale of 1 (*not at all*) to 9 (*very likely*). The four items formed a highly reliable scale (α = .96).

Behavioral indications of RSI prevention. Upon receiving the flyer about the RSI-prevention training, participants were told that the university would like to estimate the number of students interested in the training. The experimenter handed out a short form and asked participants to indicate if they wanted to reserve a seat in the training and/or wanted to subscribe for a biweekly email newsletter about RSI. Those who wanted to do so were also asked to write down their name and email address for future contact. The opportunity to subscribe to the email newsletter about RSI was provided as

an alternative way to acquire information regarding RSI prevention that participants might adopt when the RSI-prevention training was perceived as unhelpful (i.e., when it had low response efficacy).

Cognitive and Affective Reponses to the Persuasive Message

Thought-and-feeling listing tasks. Thought-and feeling-listing tasks identical to those used in Study 1 were administered twice. After participants read both the fear-arousing information and the action recommendation, they were asked to complete two thought-and-feeling listing tasks--the first one for responses to the fear-arousing information about RSI, and the second one for responses to the action recommendation.

Results

Preliminary Analysis

Manipulation Checks

Risk for RSI. As a check on the risk manipulation, participants were asked the extent to which they agreed with four statements about their risk of developing RSI, such as "If you do not take any special action now, it is likely that you will develop Repetitive Strain Injury (RSI) in the future" on a 9-point scale (1 = *strongly disagree* to 9 = *strongly agree*). A two-way Risk x Response Efficacy ANOVA indicated a significant main effect of the risk manipulation, $F(1, 118) = 42.61$, $p < .001$, such that participants in the high risk condition ($M = 5.61$, $SD = 1.55$) reported higher RSI risk than did those in the low risk condition ($M = 3.71$, $SD = 1.83$). However, there was also a significant main effect of response efficacy, $F(1, 118) = 3.47$, $p < .05$, indicating a difference in RSI risk

ratings among participants in different response efficacy conditions. A Bonferroni post-hoc test indicated that participants in the high response-efficacy condition ($M = 5.13$, $SD = 1.84$) rated themselves as somewhat more vulnerable to RSI than did those in moderate response efficacy group ($M = 4.33$, $SD = 1.98$, $t(83) = 1.93$, $p < .09$). Participants in the low response efficacy group ($M = 4.71$, $SD = 1.93$) did not significantly differ from either the moderate, $t(80) = -0.88$, $p < .38$, or the high response efficacy group, $t(79) = -1.00$, $p < .32$, in perceived RSI risk.

Response efficacy. As a check on the response efficacy manipulation, participants were asked the extent to which they agreed with three statements describing beliefs regarding efficacy of the RSI-prevention training in preventing RSI, such as "Participating in the RSI-prevention training can help lower your risk for Repetitive Strain Injury (RSI)" on a 9-point scale (1 = *strongly disagree* to 9 = *strongly agree*). A two-way ANOVA indicated a significant main effect of the response efficacy manipulation, $F(2, 118) = 6.23$, $p < .01$, on participants' rating of training effectiveness. Contrasts revealed that the means of the response efficacy rating of the three groups were in the expected order: Participants in high response-efficacy condition ($M = 5.96$, $SD = 1.67$) rated the training as more effective that did those in the low response-efficacy condition ($M = 4.79$, $SD = 1.62$, $t(121) = 3.22$, $p < .01$), while the difference between the ratings of participants in high and moderate ($M = 5.14$, $SD = 1.60$) response-efficacy conditions was marginally significant, $t(121) = 2.32$, $p < .07$). However, there was no difference in response efficacy ratings between the low and moderate response-efficacy conditions ($t < 1$). The main effect of the risk manipulation was also marginally significant, $F(1, 118) = 3.17$, $p = .078$, such that participants in the high-risk condition

(M = 5.48, SD = 1.74) rated the training as somewhat more effective than those in the low-risk condition (M = 5.11, SD = 1.62). No interaction effect was observed.

Descriptive Statistics

Correlations among optimism, the other individual differences, and the outcome measures, as well as means and standard deviations, are presented in Table 4.

Primary Results

Attitudes, Intentions, and Behavioral Indicators of Desire to Prevent RSI

Hierarchical regression analyses were used to test whether optimism, risk for RSI, and response efficacy predicted attitudes toward the RSI-prevention training and intentions to participate in the training. As in Study 1, the first step controlled for age and gender. Next, the main effects of dispositional optimism (centered), risk (dummy coded), response efficacy (dummy coded with the low response-efficacy condition as the reference group) were entered in the second step, followed by the two-way interaction terms in Step 3, and all three-way interaction terms in Step 4. Interaction slopes were interpreted for low (-1 SD) and high optimism (+1 SD)[5] according to the procedures specified in Aiken and West (1991).

Attitudes toward the RSI-prevention training. As shown in Table 5, a significant Step 2, $\Delta R^2 = .13$, $\Delta F\ (4,117) = 4.42$, $p < .01$, revealed significant main effects of dispositional optimism ($\beta = .24$, $p < .01$) and high response efficacy ($\beta = .29$, $p < .01$),

[5] Low dispositional optimists in Study 2 were those whose scores were equal to or lower than 3.24 on a scale from 1-5 of the LOT-R, whereas high dispositional optimists were those whose scores were equal to or greater than 4.52. Therefore, similar to Study 1, low optimists (i.e., pessimists) in this sample were those who indicated that they neither agreed nor disagreed with the items measuring optimism.

Table 4

Correlations and Means of Optimism, Related Individual Differences, and Attitudes Toward and Intentions to Participate in the RSI-prevention Training

	1	2	3	4	5	6	7
1. Dispositional optimism	--	.24*	.09	-.49***	.53***	.60***	.54***
2. Attitudes toward the RSI-prevention training		--	.70***	-.09	.09	.09	.02
3. Intention to participate in the training			--	.05	-.09	.00	-.00
4. Neuroticism				--	-.48***	-.68***	-.47***
5. Self-mastery					--	.58***	.44***
6. Self-esteem						--	.69***
7. Positive affectivity							--
M	3.88	5.60	4.05	2.67	5.77	3.99	3.65
SD	0.64	1.52	2.24	0.73	0.92	0.75	0.64
Range	1-5	1-9	1-9	1-5	1-7	1-5	1-5
N	124	124	124	124	124	124	124

Note. *$p < .05$. **$p \leq .01$. ***$p < .001$.

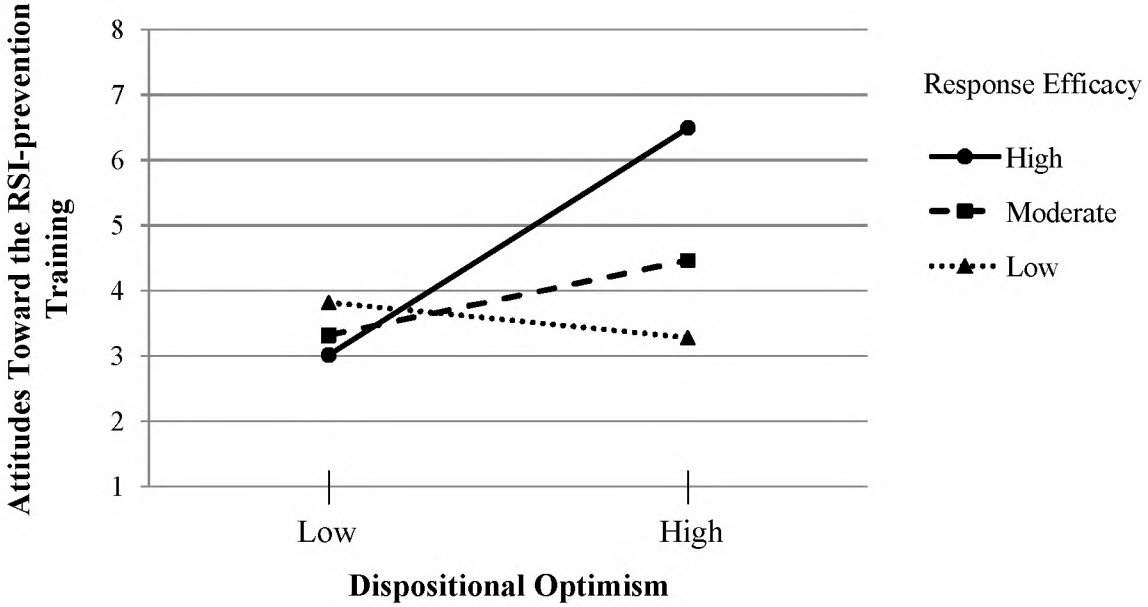
Table 5

Standardized Regression Coefficients (with ΔR^2) From Hierarchical Regression Analyses With Dispositional Optimism, Risk, and Response Efficacy Predicting Attitudes Toward and Intention to Participate in the RSI-prevention Training

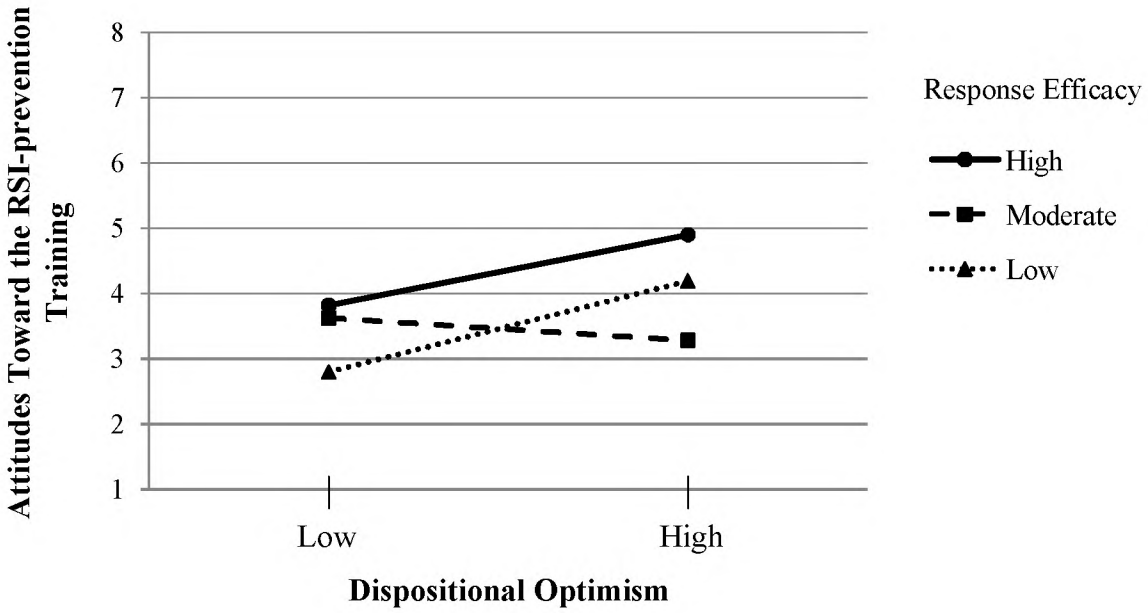
Predictor	Attitude		Behavioral intention	
	ΔR^2	β	ΔR^2	B
Step 1	.02		.00	
Age		-.04		.04
Gender		.13		.24
Step 2	.13**		.16***	
Age		-.07		.04
Gender		.12		.04
Dispositional optimism		.24*		.11
Risk		.09		.36***
Moderate response efficacy		.04		.05
High response efficacy		.29**		.22*
Step 3	.08*		.06	
Age		-.03		.07
Gender		.18		.08
Dispositional optimism		-.23		-.15
Risk		.13		.35
Moderate response efficacy		.06		.01
High response efficacy		.35		.25
Dispositional optimism x Risk		.11		.08
Dispositional optimism x Moderate response efficacy		.15		.00
Dispositional optimism x High response efficacy		.47**		.31*
Risk x Moderate response efficacy		.02		.09
Risk x High response efficacy		-.06		-.04
Step 4	.06**		.01	
Age		-.03		.08
Gender		.19		.08
Dispositional optimism		.43		.14
Risk		.08		.32
Moderate response efficacy		.00		-.01
High response efficacy		.30		.23
Dispositional optimism x Risk		-.50		-.19
Dispositional optimism x Moderate response efficacy		-.24		-.21
Dispositional optimism x High response efficacy		-.05		.11
Risk x Moderate response efficacy		.06		.10
Risk x High response efficacy		-.01		-.02
Dispositional optimism x Risk x Moderate response efficacy		.34*		.22
Dispositional optimism x Risk x High response efficacy		.50**		.16

Note. *$p < .05$. **$p < .01$. ***$p < .001$.

such that higher optimism and high response efficacy predicted more favorable attitudes toward the RSI-prevention training. A significant Step 3, $\Delta R^2 = .08$, ΔF (5,112) = 2.41, $p < .05$, contained a significant Dispositional Optimism x High Response Efficacy interaction ($\beta = .47$, $p < .01$). Importantly, in the last step of the analysis, $\Delta R^2 = .06$, ΔF (2,110) = 4.98, $p < .01$, there were significant three-way Dispositional Optimism x Risk x High Response Efficacy ($\beta = .50$, $p < .01$) and Dispositional Optimism x Risk x Moderate Response Efficacy interactions ($\beta = .34$, $p < .05$). As shown in Figure 9, when RSI risk was high, dispositional optimism significantly predicted more favorable attitudes when the training was highly effective (slope = 2.72, t (116) = 4.77, $p < .001$), showed a trend in predicting more favorable attitudes when the training was moderately effective (slope = 0.89, t =1.68, $p < .10$), and did not predict attitudes when the training was ineffective (slope = -0.42, $t < 1$). When RSI risk was low, dispositional optimism significantly predicted more favorable attitudes when the training was highly effective (slope = 0.84, t (116) = 2.40, $p < .02$), but was not related to attitudes toward the RSI-prevention training when it was ineffective (slope = 1.08, t (116) = 1.40, $p < .17$) or moderately effective (slope = -0.27, $t < 1$). Regression line comparisons at the specific values of optimism (i.e., 1 *SD* above and below the mean) in the high risk condition showed that optimists' attitudes toward the training were more favorable when the training was highly effective than when it was moderately effective (t (37) = 2.23, $p < .05$) or ineffective (t (40) = 4.15, $p < .001$), while optimists' attitudes toward the moderately effective and ineffective trainings were not significantly different from each other (t (43) = 1.51, $p < .14$). Pessimists' attitudes toward the training, however, did not differ as a function of its stated efficacy (high vs. moderate efficacy, $t < 1$; moderate vs. low efficacy, $t < 1$; high vs. low



a. High-risk condition.



b. Low-risk condition.

Figure 9. Relation of dispositional optimism to predicted attitudes toward the RSI-prevention training, as a function of response efficacy, in the high- and low-risk conditions.

Note. Higher numbers indicate more favorable attitudes.

efficacy, t (40) = -1.53, $p < .14$). Finally, the slope of the highly effective training in the high-risk condition was significantly greater than that in the low-risk condition (t (38) = 3.29, $p < .01$), indicating that the moderating effect of optimism on attitudes toward highly effective training was stronger in the high- than the low-risk condition.

To summarize, when at high risk for RSI, dispositional optimists showed significant more favorable attitudes toward the highly effective RSI-prevention training, showed a trend to enhance attitudes toward the moderately effective training, and did not differ from pessimists in their attitudes toward ineffective training. Optimists at high risk also evaluated the highly effective training as significantly better than the moderately effective and ineffective trainings. This pattern of the results in large part supported the prediction based on the outcome valence-focused processing that optimistic beliefs increase responsiveness to likelihood of obtaining positive outcomes (i.e., reducing RSI risk). Interestingly, there was an unpredicted enhancement effect of dispositional optimism on the highly effective training in the low-risk condition, indicating that optimists evaluated the highly effective training more positively than did pessimists even though their risk for RSI was low.

Intention to participate in the RSI-prevention training. Overall, participants showed rather low intentions to join the RSI-prevention training (M = 4.05 on a scale from 1 to 9, SD = 2.24). Participants' intention to join the RSI-prevention training was examined using primary hierarchical regression analyses. As shown in Table 5, only the second step was significant, $\Delta R^2 = .16$, ΔF (4,117) = 5.48, $p < .001$, with main effects of the risk manipulation ($\beta = .36$, $p < .001$) and high response efficacy ($\beta = .22$, $p < .05$), such that participants in the high-risk condition and highly effective training condition

showed stronger intentions to participate in the RSI-prevention training. Dispositional optimism, however, was not a significant predictor. No other significant results were obtained. Therefore, dispositional optimism did not predict intentions to participate in the RSI-prevention training.

Behavioral indications of desire to prevent RSI. To examine whether optimism, RSI risk, and response efficacy predicted seat reservation for the RSI-prevention training and subscription to the biweekly RSI email newsletter, sequential logistic regression analyses were performed separately for each outcome using the steps similar to the primary hierarchical regression analysis. A number of 1 was given if participants checked the box indicating that they wanted to reserve a seat for the training, or if they provided their email address for receiving the email newsletter. A number of 0 was given if they did not do so. Due to a technical problem, we failed to collect the responses from 20 participants for both the seat reservation and the newsletter subscription, leaving N = 104 for the logistic regression analyses.

Seat reservation for the RSI-prevention training. Overall, 21 participants (20.19%) reserved a seat for the RSI-prevention training, while 83 did not. Results of the logistic regression analyses with dispositional optimism revealed a significant second step, χ^2 (4, N = 104) = 13.33, p = .01, R^2 (Cox & Snell) = .15, with a significant main effect of the risk manipulation (B = 2.11, p < .01). The model correctly predicted 81.7% of cases. More participants in the high-risk condition (3.85%) than those in the low-risk condition (0.40%) were likely to reserve a seat for the RSI-prevention training. No other significant results were observed.

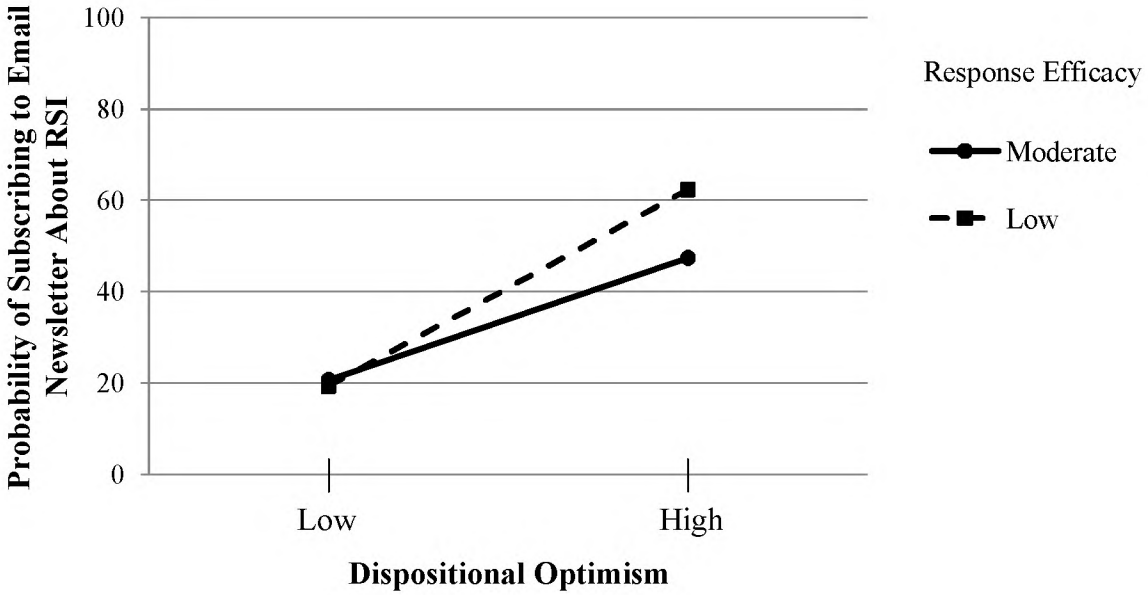
Subscription to the biweekly email newsletter regarding RSI. Twenty-nine

participants (27.9%) provided their email addresses in order to receive the RSI newsletter, while 75 of them did not. A sequential logistic regression revealed a significant last step, χ^2 (2, N = 104) = 6.13, $p < .05$), R^2 (Cox & Snell) = .22, with a marginally significant Dispositional Optimism x Risk x Moderate Response Efficacy interaction (B = 5.86, p = .086). The model with the three-way interaction correctly predicted 72.1% of cases. As shown in Figure 10, when RSI risk was high, optimists (62.41%) were predicted to be more likely to subscribe to the RSI newsletter than pessimists (19.35%) when the RSI-prevention training was ineffective. When the training was moderately effective, optimists (47.37%) were more likely than pessimists (20.63%) to subscribe to the RSI newsletter. When RSI risk was low, optimists (80.62%) were more likely than pessimists to subscribe to the newsletter (2.34%) when the training program was ineffective. When the training was moderately effective, however, optimists at low risk (3.76%) were less likely than pessimists (44.44%) to subscribe to the newsletter.

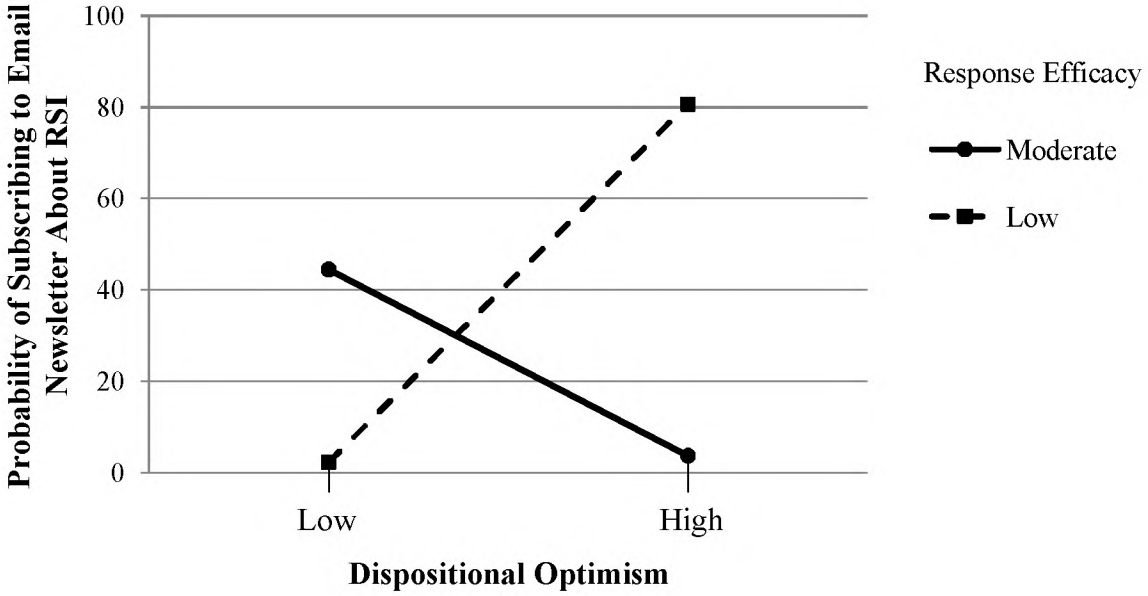
The email newsletter may have represented alternative means of attaining useful information about preventing RSI, especially when the training was described as unhelpful. Our findings indicated that when RSI risk was high, dispositional optimists were more likely than pessimists to seek potentially useful information about RSI and RSI prevention. This is especially true when the training was said to be ineffective.

Cognitive and Affective Responses to the Fear-arousing Communication

Two independent raters coded thoughts and feelings listed in the thought-and-feeling listing tasks separately for responses to the fear-arousing information about RSI



a. High-risk condition.



b. Low-risk condition.

Figure 10. Relation of dispositional optimism to predicted probability of subscribing to email newsletter about RSI, as a function of moderate and low response efficacy of the RSI-prevention training, in the high- and low-risk conditions.

Note. Higher numbers indicate higher probability.

and responses to the RSI-prevention training. Then, a proportion of positive thoughts index, a proportion of negative thoughts index, and an affective response index were created for each set of responses using the same procedure employed in Study 1. Correlations among the cognitive and affective indices, optimism, and the main outcomes are presented in Table 6. The correlations among the six cognitive and affective indices from the thought-and-feeling listing tasks indicated that these indices did not overlap.

Thoughts and feelings in response to fear-arousing information about RSI. Similar to Study 1, affective responses were categorized into three mutually exclusive categories: positive affective responses, negative affective responses, and neutral feelings (see Appendix F for frequency of each category). Cognitive responses were categorized into seven mutually exclusive categories: positive thoughts or thoughts in agreement with the information about RSI health threat ("*The information is helpful*"), negative thoughts or thoughts counterarguing the information about RSI health threat ("*I think RSI is kind of silly because it's something that is resolved by common sense*"), thoughts regarding perceptions of high risk and severity of RSI ("*I knew I would probably be at high risk for RSI*"), thoughts regarding perceptions of low risk and severity of RSI ("*My work is hands on so I really do not consider myself at risk"),* thoughts indicating desire to reduce RSI risk ("*If it is a slow process, it is important to use prevention now*"), thoughts indicating desire for further information ("*I should probably learn more*"), and unrelated thoughts (see Appendix F for frequency of each category). Agreement between the two judges was 86.81%. It should be noted that some participants listed thoughts about the RSI-prevention training when they were asked to provide thoughts about risk and severity of RSI, and vice versa. In this case, the judges independently identified thoughts that were

Table 6

Correlations Among Optimism, Cognitive and Affective Response Indices, and Attitudes Toward and Intention to Participate in the RSI-prevention Training

	1	2	3	4	5	6	7	8	9
1. Dispositional optimism	--	-.04	.09	-.08	-.22*	.03	.20*	.24**	.09
2. Proportion of negative thoughts about RSI		--	-.08	.09	.30**	-.07	-.11	-.36***	-.17^{+}
3. Proportion of positive thoughts about RSI			--	-.15	-.04	-.01	-.11	.04	-.01
4. Negative affective response to RSI				--	.06	-.10	-.02	-.09	.01
5. Proportion of negative thoughts about RSI-prevention training					--	-.10	-.24**	-.39***	-.34***
6. Proportion of positive thoughts about RSI-prevention training						--	.25**	.03	-.03
7. Positive affective response to RSI-prevention training							--	.17^{+}	.13
8. Attitudes toward the RSI-prevention training								--	.70***
9. Intention to participate in the RSI-prevention training									--

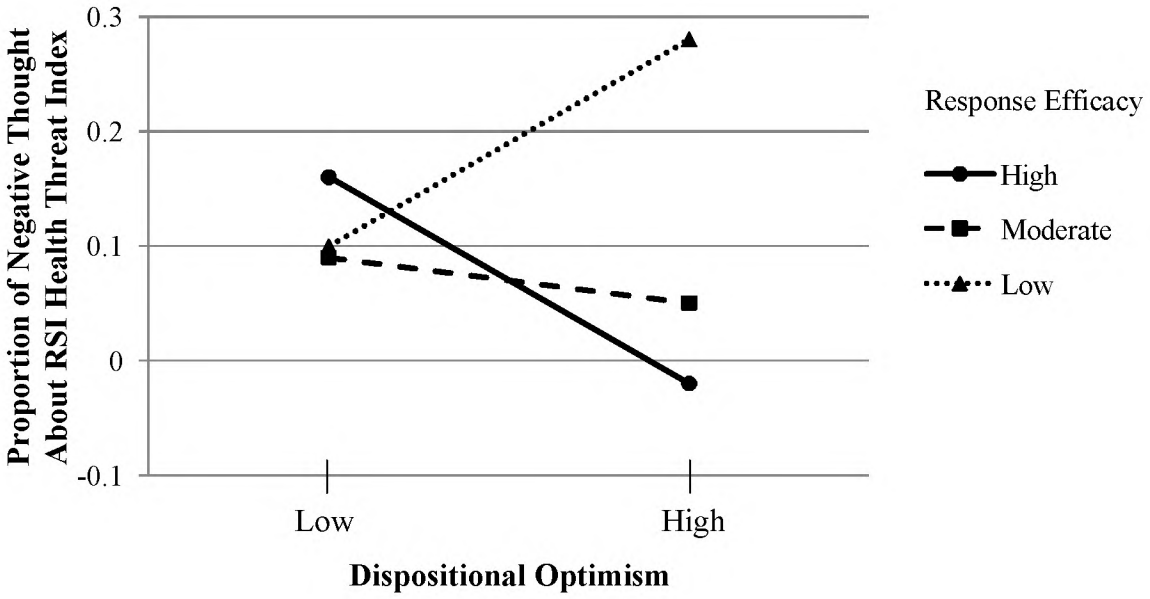
Note. $^{+}p < .06$. $*p < .05$. $**p \leq .01$. $***p \leq .001$.

in the wrong category and these thoughts were analyzed in the correct category. Disagreements about coding or category assignment were resolved through discussion. Three response indices were created, including a proportion of negative thought index (created from the negative thoughts counterarguing the information about RSI health threat), a proportion of positive thoughts (created from the positive thoughts agreeing with the information about RSI health threat), and a negative affective response index. Each of the cognitive and affective indices was then entered in hierarchical regressions similar to the primary analysis.

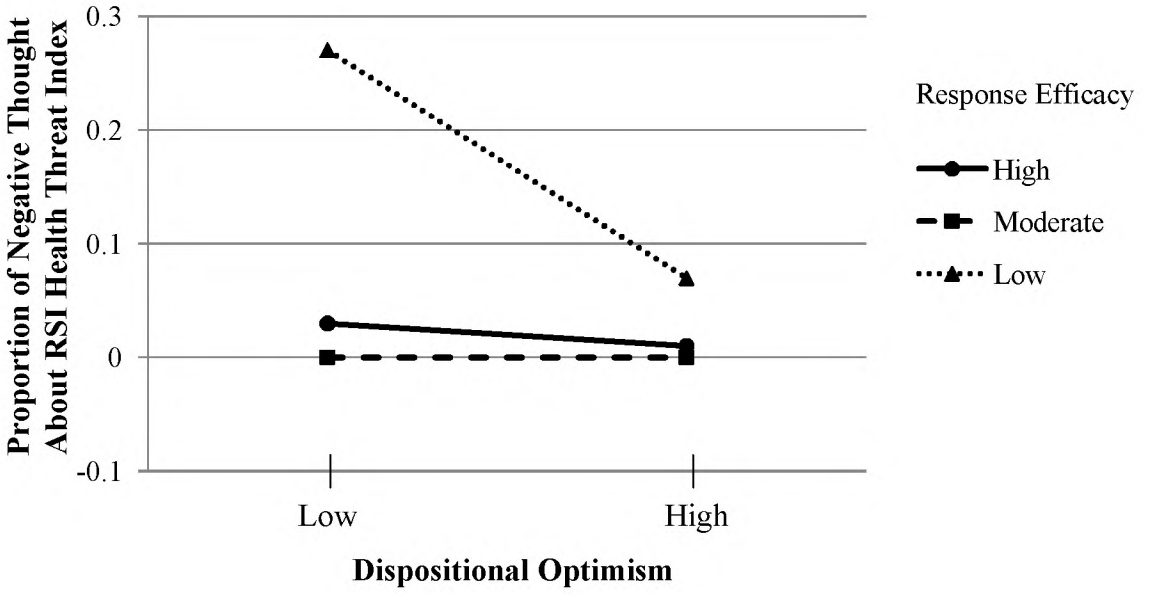
Proportion of negative thought about RSI health threat index. The second step

of the analysis, $\Delta R^2 = .10$, $\Delta F\,(4,117) = 3.32$, $p < .05$, revealed main effects of moderate response efficacy ($\beta = -.31$, $p < .01$) and high response efficacy ($\beta = -.28$, $p < .01$), such that participants generated a lower proportion of thoughts counterarguing the fear-arousing information about RSI when the RSI-prevention training was either moderately or highly effective. Interestingly, in a significant Step 4, $\Delta R^2 = .06$, $\Delta F\,(2,110) = 4.00$, $p < .05$, there was a marginally significant Dispositional Optimism x Risk x Moderate Response Efficacy ($\beta = -.34$, $p = .061$) and a significant Dispositional Optimism x Risk x High Response Efficacy interaction ($\beta = -.48$, $p < .01$). As depicted in Figure 11, when RSI risk was high, dispositional optimism significantly predicted a greater proportion of negative thoughts counterarguing against the information about RSI health threat only when the training was ineffective (slope = 0.14, $t\,(120) = 2.33$, $p < .05$), but did not predict the proportion of such thoughts when the training was moderately (slope = -0.03, $t < 1$) or highly effective (slope = -0.14, $t\,(116) = -1.40$, $p < .17$). However, when RSI risk was low, dispositional optimism was unrelated to the proportion of counterarguments to the information about RSI health threat when the effectiveness of the training was low (slope = -0.15, $t\,(120) = -1.50$, $p < .14$), moderate (slope = 0.00, $t < 1$), or high (slope = -0.02, $t < 1$). No other significant results were observed.

In sum, optimists generated a greater proportion of counterarguments against the fear-arousing information about the RSI health threat than did pessimists when the RSI-prevention training was not effective in preventing RSI, and this tendency was intensified in the high-risk condition. Interestingly, the finding that optimists derogated the health threat to a greater extent than pessimists when the training was ineffective contradicted our prediction that optimists at high risk for RSI, regardless of the stated effectiveness of



a. High-risk condition.



b. Low-risk condition.

Figure 11. Relation of dispositional optimism to predicted proportion of negative thought about RSI health threat index, as a function of response efficacy, in the high- and low-risk conditions.

Note. Higher numbers indicate greater proportion of negative thoughts.

the training program, would be less defensive in processing fear-arousing information about the health threat.[6]

Proportion of positive thought about RSI health threat index. A marginally significant Step 2 of the analysis, $\Delta R^2 = .07$, $\Delta F\ (4,117) = 2.15$, $p = .079$, revealed a significant main effect of the risk manipulation ($\beta = -.24$, $p < .01$) such that participants at high risk for RSI listed a lower proportion of positive thoughts in response to the fear-arousing information about RSI. No other significant results were obtained. Thus, dispositional optimism was not a significant predictor of the proportion of positive thoughts about RSI.

Negative affective response to RSI health threat index. Step 3 of the analysis, $\Delta R^2 = .08$, $\Delta F\ (5,112) = 2.32$, $p < .05$, revealed a marginally significant Dispositional Optimism x Risk interaction ($\beta = .24$, $p = .059$). As depicted in Figure 12, dispositional optimism was marginally significant in predicting fewer negative affective responses to

---

[6] Because no previous study has documented optimists' tendency to react defensively to threatening information, we tested the possibility that the predictive effect of dispositional optimism on counterarguments against the RSI health threat was contributed by the pessimism factor of the construct, according to the bidimensional view of dispositional optimism (Chang, D'Zurilla, & Maydeu-Olivares, 1994; Chang, Maydeu-Olivares, & D'Zurilla, 1997; Kubzansky, Kubzansky, & Maselko, 2004). A pessimism factor was calculated based on an average of three negatively worded LOT-R items. The proportion of negative thought counterarguing against RSI health threat was regressed on pessimism factor (centered), manipulated RSI risk, and response efficacy. No effects of pessimism were significant. However, when the pessimism factor was replaced by the optimism factor comprised of participants' scores on the three positively worded LOT-R items, the Optimism Factor x Risk x High Response Efficacy interaction was significant ($\beta = -.46$, $p < .05$) in a significant Step 4, $\Delta R^2 = .05$, $\Delta F\ (2,110) = 3.28$, $p < .05$, such that when RSI risk was high, the optimism factor significantly predicted a greater proportion of negative thoughts counterarguing against the fear-arousing information about the RSI health threat when the RSI-prevention program was ineffective (slope = 0.13, $t\ (120) = 3.25$, $p < .01$), but predicted lower proportion of such thought when the training was highly effective (slope = -0.13, $t\ (116) = -2.17$, $p < .04$). However, when RSI risk was low, the optimism factor did not predict proportion of negative thoughts counterarguing against RSI health threat when the training was either ineffective (slope = -0.07, $t < 1$) or highly effective (slope = -0.02, $t < 1$). It should be noted that the patterns of slopes in the high-risk condition mimicked those observed in the analysis with the complete dispositional optimism scale. These results thus suggested that it was the optimism, not the pessimism, factor of dispositional optimism that produced the patterns of results in predicting the proportion of negative thoughts counterarguing the fear-arousing information about RSI health threat in the low response-efficacy condition.

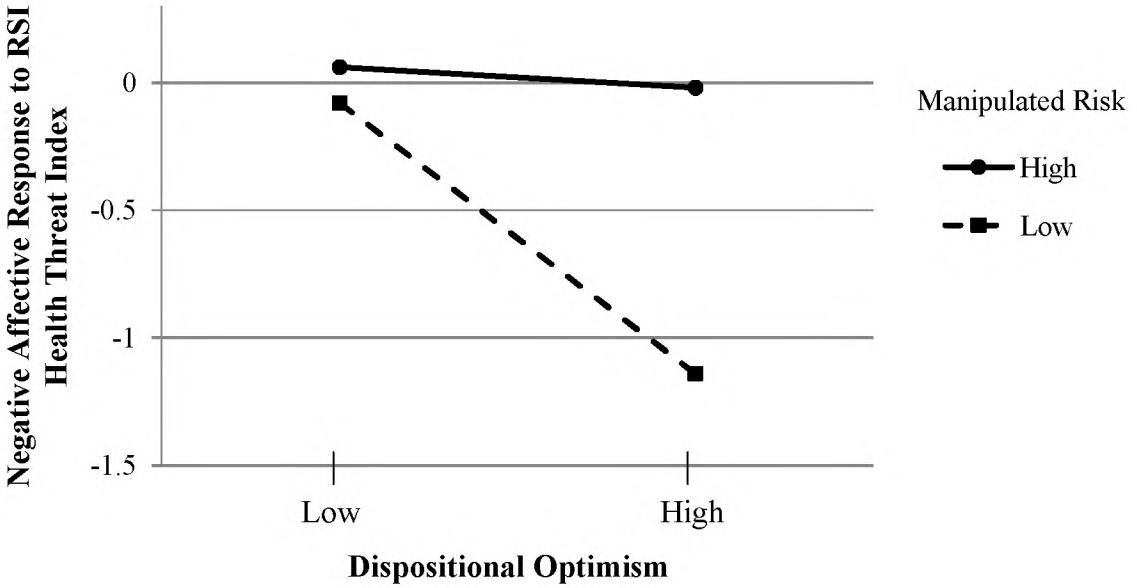


Figure 12. Relation of dispositional optimism to predicted negative affective response to RSI health threat index, as a function of the risk manipulation.

Note. Higher numbers indicate greater negative affective responses.

the RSI health threat in the low-risk condition (slope = -0.83, t (120) = -1.77, $p < .08$), but did not predict responses to the high-risk condition (slope = -0.07, $t < 1$).

Overall, optimists reported fewer negative affective responses to the fear-arousing information about RSI health threat than did pessimists when they were at low risk for RSI or when there was low possibility that they would experience the negative outcomes from the threat. These results did not support our hypothesis that optimists would show less negative affective responses to the fear-arousing information about RSI when their risk was high, regardless of the RSI-prevention training efficacy.

Thoughts and feelings in response to the RSI-prevention recommendation. Two judges used the same procedure to code participants' lists of thoughts and feelings toward the RSI-prevention training. Affective responses were categorized into positive, negative, and neutral affective responses (see Appendix G for frequency of each

category). Cognitive responses were categorized into five mutually exclusive categories: positive thoughts regarding the RSI-prevention training ("*I think the recovery program would be good to help people become aware of a potential problem with RSI*"), negative thoughts regarding the RSI-prevention training ("*I thought that the 12% benefit was a little low*"), thoughts indicating desire to prevent RSI ("*I need to prevent any further risk*"), thoughts indicating desire for more information ("*I want to learn more*"), and unrelated thoughts (see Appendix G for frequency of each category). Agreement between the two judges was 93.51%. Coding disagreements were resolved through discussion. The following three response indices were created: a proportion of positive thought index (created from positive thoughts regarding the RSI-prevention training), a proportion of negative thoughts index (created from the negative thoughts regarding the RSI-prevention training), and a positive affective response index (created by subtracting the number of negative affective responses from the number of positive affective responses of each participant). Each of the cognitive and affective indices was then subjected to hierarchical regressions similar to the primary analysis.

Proportion of negative thought about the RSI-prevention training index. The analysis revealed no significant results, indicating that dispositional optimism was not related to the proportion of negative thoughts about the training.

Proportion of positive thought about RSI-prevention training index. The analysis yielded no significant results.

Positive affective response to RSI-prevention training index. The second step, $\Delta R^2 = .08$, $\Delta F\ (4,117) = 2.70$, $p < .05$, revealed a significant main effect of dispositional optimism ($\beta = .22$, $p < .05$). These results indicated that optimism predicted greater

positive affects in response to the RSI-prevention training. No other significant results were found. Unlike the findings that optimism interacted with the risk manipulation in predicting negative affective responses to the information about RSI health threat, optimists showed greater positive affective responses to the RSI-prevention training than did pessimists, regardless of the response efficacy and risk manipulations. These findings did not support our prediction that optimists would show greater positive affective responses to the training when RSI risk was high and the training was highly effective, as compared to pessimists.

In sum, dispositional optimists showed fewer negative affective responses to the fear-arousing information about RSI health threat compared to pessimists, but only when their RSI risk was low. Optimists also showed greater positive affective responses to the recommended action regardless of its effectiveness. With regard to the cognitive responses, optimism was not related to either the proportion of positive thoughts in responses to both kinds of information or the proportion of negative thoughts about the training recommendation. Optimism, however, predicted a greater proportion of counterarguments against the fear-arousing information about RSI when the training was ineffective.

Mediation Analyses

We have shown that dispositional optimism, risk for a health threat, and response efficacy interacted to predict the proportion of negative thoughts about RSI as a health threat. We next tested whether the proportion of negative thoughts about RSI explained the moderating effects of dispositional optimism on attitudes toward the RSI-prevention

training. In accordance with Muller, Judd, and Yzerbyt (2005) who proposed a procedure to perform mediated moderation analysis, the proportion of negative thoughts was tested as a potential mediator of the Dispositional Optimism x Risk x Moderate Response Efficacy and the Dispositional Optimism x Risk x High Response Efficacy interactions on attitudes toward the RSI-prevention training. As shown in Table 7, in the first regression equation, attitudes toward the RSI-prevention training were regressed on dispositional optimism, risk manipulation, moderate response efficacy, high response efficacy, and their interactions. The three-way Dispositional Optimism x Risk x Moderate Response Efficacy (β = .38, p < .05) and the Dispositional Optimism x Risk x High Response Efficacy interactions (β = .48, p < .01) were significant. In the second regression equation, the proportion of negative thoughts was regressed on dispositional optimism, risk manipulation, moderate response efficacy, high response efficacy, and their interactions. The three-way Dispositional Optimism x Risk x Moderate Response Efficacy (β = -.36, p < .05) and the Dispositional Optimism x Risk x High Response Efficacy interactions (β = -.48, p < .01) were significant. Finally, in the third regression equation, attitudes toward the RSI-prevention training was regressed on dispositional optimism, risk manipulation, moderate response efficacy, high response efficacy, and their interactions, as well as the proportion of negative thoughts and the interaction of the proportion of negative thoughts and dispositional optimism. The results indicated that the proportion of negative thoughts was significant (β = -.28, p < .01), whereas the effect of the Dispositional Optimism x Risk x Moderate Response Efficacy interaction became nonsignificant (β = .26, p < .13), and that of the Dispositional Optimism x Risk x High Response Efficacy interaction (β = .29, p < .08) became marginally significant, indicating

Table 7

Standardized Regression Coefficients (with ΔR^2) From Mediated Moderation Analyses of Proportion of Negative Thought About RSI Health Threat Index on Attitudes Toward RSI-prevention Training

Predictor	Criterion		
	Step 1	Step 2	Step 3
	Attitude	Proportion of negative thought	Attitude
Dispositional optimism	.53	-.52	.13
Risk	.05	.02	.03
Moderate response efficacy	-.04	-.35*	-.14
High response efficacy	.27	-.32*	.18
Dispositional optimism x Risk	-.54*	.65*	-.31
Dispositional optimism x Moderate response efficacy	-.29	.30	-.06
Dispositional optimism x High response efficacy	-.11	.30	.13
Risk x Moderate response efficacy	.08	.09	.13
Risk x High response efficacy	-.01	.07	.04
Dispositional optimism x Risk x Moderate response efficacy	.38*	-.36*	.26
Dispositional optimism x Risk x High response efficacy	.48**	-.48**	.29^{+}
Proportion of negative thought index			-.28**
Proportion of negative thought index x Dispositional optimism			.18
R^2	.26***	.18*	.34***

Note. $^{+}p < .08$. $*p < .05$. $**p < .01$. $***p < .001$.

at least partial mediation. Sobel tests of mediation were performed to test the mediating effect of the proportion of negative thoughts about RSI health threat index. The results indicated that the indirect effect of the Dispositional Optimism x Risk x High Response Efficacy interaction on the attitudes (as mediated by proportion of negative thoughts) was significantly different from zero ($z = 2.14$, $p < .04$), suggesting a significant mediation effect. However, the indirect effect of the Dispositional Optimism x Risk x Moderate Response Efficacy interaction on the attitude was marginally different from zero ($z = 1.71$, $p < .09$), indicating at least a marginally significant mediation of the interaction.

The results of the mediation analysis suggested that the proportion of negative thoughts about RSI health threat mediated the moderating role of dispositional optimism on the effects of the risk manipulation and high response efficacy on attitudes toward the RSI-prevention training, such that optimists at high risk for RSI generated a greater proportion of negative thoughts counteraruging against RSI health threat than did pessimists when the training was ineffective, and this greater proportion of negative thoughts predicted more negative attitudes toward the training. Thus, optimists' positive attitudes toward the highly effective training were at least partly determined by lower counterarguments against RSI. These results did not support our prediction that cognitive responses to the training mediated the moderating effect of optimism on attitudes toward the training. Instead, thoughts counterarguing against RSI health threat were a significant mediator. In addition, unlike the results of Study 1, none of the affective response indices from the thought-and-feeling listing tasks was significantly predicted by the interactions among dispositional optimism, risk, and response efficacy, suggesting that the affective responses to the training were not mediators of the relationship between these interactions and attitudes toward the training. These results did not support our prediction that affective responses to the training mediated the moderating effect of optimism on attitudes toward the training.

Tests of Confounding Effects of Other Individual Differences

To examine whether neuroticism, trait self-esteem, self-mastery, and trait positive affectivity were responsible for the predictive effects of optimism obtained for attitudes

toward the RSI-prevention training,[7] each individual difference and its interaction terms were added to the primary hierarchical regression analyses as simultaneous predictors with optimism. With self-mastery or trait positive affectivity in the equations, the Dispositional Optimism x Risk x High Response Efficacy and the Dispositional Optimism x Risk x Moderate Response Efficacy effects remained significant and virtually equivalent in magnitude, suggesting that these individual differences did not confound the effects of dispositional optimism reported earlier.

Entering trait self-esteem or neuroticism simultaneously in the same model with dispositional optimism, however, affected the magnitude and significance of the predictive effects of these interactions on attitudes toward the RSI-prevention training. With self-esteem in the model, the Dispositional Optimism x Risk x High Response Efficacy interaction was marginally significant (dropping from $\beta = .50$, $p < .01$ to $\beta = .38$, $p < .06$), while the effect of the Dispositional Optimism x Risk x Moderate Response Efficacy interaction remained significant with an increase in magnitude (from $\beta = .34$, $p < .05$ to $\beta = .40$, $p < .05$). With neuroticism in the equation, the magnitude of both interactions was reduced (from $\beta = .50$, $p < .01$ to $\beta = .40$, $p < .05$ for the Dispositional Optimism x Risk x Moderate Response Efficacy, and from $\beta = .34$, $p < .05$ to $\beta = .27$, $p < .17$ for the Dispositional Optimism x Risk x High Response Efficacy interaction). These results did not provide strong evidence that trait self-esteem and neuroticism were

[7] Hierarchical regression analyses were also conducted in order to test whether neuroticism, trait self-esteem, self-mastery, and trait positive affectivity confounded the predictive effects of optimism on the proportion of counterarguments against the fear-arousing information about RSI health threat, the negative affective responses to RSI health threat, and the positive affective response to the RSI-prevention training indices. Results indicated that dispositional optimism maintained its predictive effects on these outcomes and that the observed effects of optimism could not be attributed to these individual differences.

responsible for the predictive effects of the two interactions of dispositional optimism.[8] In sum, the moderating effects of dispositional optimism on attitudes toward the RSI-prevention training as a function of risk for RSI and the effectiveness of the training program observed in Study 2 were not produced by neuroticism, trait self-esteem, self-mastery, and trait positive affectivity.[9]

Discussion

Study 2 extended Study 1 by specifically testing how optimistic beliefs moderated thoughts, feelings, and attitudes toward a health-prevention behavior following exposure to fear-arousing information about a health threat. Dispositional optimists at high risk for a serious health threat showed more favorable attitudes only toward a highly effective

---

[8] When each individual difference was considered as a predictor of attitudes toward the RSI-prevention training in the same model as dispositional optimism, there was a significant effect of the Neuroticism x High Response Efficacy interaction (β = -.36, $p < .05$) in Step 3, $\Delta R^2 = .13$, ΔF (8,108) = 2.13, $p < .05$, such that neuroticism significantly predicted more favorable attitudes toward the RSI-prevention training when the training was described as ineffective (slope = 0.97, t (120) = 2.02, $p < .05$), but did not predict such attitudes when the training was described as highly effective (slope = -0.27, $t < 1$). Importantly, unlike dispositional optimism, neuroticism did not appear to interact with risk for RSI in predicting attitudes toward the training. A Self-esteem x High Response Efficacy interaction was also marginally significant (β = .35, p = .06) in Step 3, $\Delta R^2 = .15$, ΔF (8,108) = 2.94, $p < .01$. Simple slope testing revealed no significant slopes for self-esteem as a predictor of attitudes toward the RSI-prevention training. Patterns of the slopes, however, indicated that both low and high self-esteem individuals reported more favorable attitudes toward the highly effective training than the ineffective training, while high self-esteem individuals showed greater differences in attitudes between highly and low effective training than did low self-esteem individuals. It should be noted that these are the same patterns obtained when optimism was a predictor; however, these results were not moderated by manipulated RSI risk.

[9] We also examined each individual difference alone as a replacement predictor for optimism in predicting attitudes toward the RSI-prevention training. To briefly summarize, self-esteem, positive affectivity, and neuroticism interacted with high response efficacy in predicting attitudes toward the training. The interactions involving self-esteem and positive affectivity yielded a similar pattern to that found for optimism. High self-esteem and high in positive affectivity were associated with differential responsiveness to the high and low response efficacy manipulation, with more favorable attitudes following the highly effective training. However, participants higher in neuroticism showed the opposite pattern, indicating rather similar responses to both high and low response efficacy manipulations. Interestingly, while optimism was not a significant predictor of intention to participate in the RSI-prevention training, a Self-esteem x High Response Efficacy interaction significantly predicted intention to participate in the training. High self-esteem predicted stronger differentiation between highly effective and ineffective training in predicting intention to participate in the training, as compared to low self-esteem, with stronger intention when the training was said to be highly effective.

recommended action. However, this response was also evidenced in low risk circumstances, but with a weaker effect. Interestingly, when the recommended action was perceived to be ineffective, optimists generated greater counterarguments against the health threat, and were more likely to deploy an alternative mean to prevent the threat as compared to pessimists. These findings provide insight into how optimism belief affects people's responses to fear-arousing communications. While such belief promotes positive affect in response to recommended actions in general, optimists' attitudes show differentiation between high versus moderate and low efficacy recommended actions, and they accept only the highly effective recommended action which provides promising results in preventing health threat.

Optimists' Enhancement Effect on Attitudes Toward the Highly Effective Action Recommendation

In the face of a serious health threat, do people with a rosy outlook on life feel threatened and take whatever is recommended as preventive measure? We obtained no evidence that optimists showed an overall positive bias, which is a documented manifestation of defensively motivated processing of fear-arousing information (Das et al., 2003; de Hoog et al., 2005), in evaluating an action recommendation that would not produce desirable results in preventing a significant health risk. Optimists' attitudes toward an action recommendation, instead, indicated responsiveness to the likelihood of the favorable outcomes of adopting the recommendation. When the desirable results (i.e., lowering health risk) of adopting an action recommendation were highly likely, optimists showed more favorable attitudes toward it compared to pessimists. That is, the high-

efficacy RSI-prevention training which was clearly associated with a high likelihood of positive future outcomes was evaluated more positively by optimists than pessimists, especially when RSI risk was high. When the training possessed equal chance of success and failure in preventing RSI (i.e., the moderately effective training) and thus was associated with ambiguous future consequences, optimists evaluated it slightly more positively compared to pessimists. However, for the low-efficacy training which was associated with low possibility of positive consequences in averting the health threat, optimists did not evaluate such training more positively as compared to pessimists. A potential reason that optimists did not rate such training more negatively than did pessimists, according to the idea of optimists' outcome valence-focused processing, is that the low-efficacy training was not obviously related to negative consequences (that is, participating in the training was unlikely to increase one's RSI symptoms or risk, though one could expect that in an absence of effective prevention, risk for RSI could increase). The patterns of the optimists' attitudes toward the RSI-prevention training also indicated greater differentiation among different levels of training efficacy of optimists than of pessimists, especially between the highly effective and ineffective training, which indicated that optimists took into account the effectiveness of the RSI-prevention training to a greater extent than did pessimists. Therefore, in line with the findings from Study 1 concerning attitude change, Study 2 demonstrated that optimists' attitudinal judgments regarding self-relevant health-prevention behavior were influenced by the likely outcome valence of adopting the behavior, especially the clearly positive outcome (i.e., the highly effective training).

Optimists' Affective Responses to Fear-arousing Information About Health Threats

We hypothesized that optimistic beliefs, which are typically associated with greater perceived coping resources (Chang, 1998; Kaiser et al., 2004), would buffer respondents against the negative emotional outcomes of facing fear-arousing information about health threats in the high- but not the low-risk circumstance. The Study 2 findings did not support this prediction. In contrast, dispositional optimists showed lower negative affective responses to the fear-arousing information than did pessimists when the risk was low. However, when at high risk, optimists reported negative feelings about RSI to the same extent as pessimists. A possible explanation is that RSI is a rather new threat to participants, and therefore optimists at high risk may require further information in order to determine whether the threat could be successfully managed. As a result, the role of optimists' perceived greater coping resources is not evidenced via decreased negative affective responses to RSI health threat when the risk was high.

Unlike Study 1, which documented a significant role of affective responses in explaining attitude change, neither affective responses to the RSI-prevention training recommendation nor those in response to the fear-arousing information about RSI in Study 2 accounted for dispositional optimism's moderation of attitudes toward the training. As suggested above, a potential explanation is that the training was a novel attitude object to participants, and they thus had limited responses toward it based on the information they received as part of the study. Previous research that obtained mediating effects of emotional responses to persuasive messages used attitude objects that participants had prior knowledge of and attitudes about, for example, attitudes toward

allowing gay people in the military (Zuwerink & Devine, 1996) and attitudes toward animal testing (Rosselli et al., 1995), as well as attitudes toward current caffeine consumption practices in Study 1. In such circumstances, persuasive messages may elicit stronger responses, possibly both cognitive and affective, in the recipient. Participants' affective responses to such novel attitude objects as the RSI-prevention training and RSI health threat might be rather weak, and therefore may fail to explain their attitudes toward the training.

Optimists' Responses to the Ineffective Action Recommendation for Reducing RSI risk

Surprisingly, we found that dispositional optimists at high risk for RSI listed greater counterarguments against RSI health threat, but only when the RSI-prevention training was ineffective. When RSI risk was low, however, dispositional optimism was not related to counterarguments against RSI. The proportion of counterarguments against the RSI health threat also explained optimism's moderation of attitudes toward the training, with fewer counterarguments against RSI health threat predicting more favorable attitudes toward the training. However, thoughts regarding the RSI-prevention training recommendation, either positive or negative, did not appear to explain optimists' and pessimists' attitudes toward the training. These results were inconsistent with previous research which found that thoughts about an action recommendation explained attitudes toward the recommendation (de Hoog et al., 2005).

Why did optimists reject the health threat in the face of an ineffective remedy? Our explanation is that optimism may increase sensitivity to the likelihood of attaining

future positive (and negative) outcomes, especially when such outcomes are important to the self. Increased attention to the valence of potential future outcomes might inform optimists that the ineffective training with a 12% chance of successful prevention was unlikely to provide positive outcomes in coping with RSI. Optimists, therefore, might switch their coping strategy by disengaging from the goal of preventing RSI and adopting an avoidance coping strategy via derogation of this seemingly unpreventable threat.

Optimists' threat derogation when the preventive action was not reassuring is in line with the EPPM (Witte, 1992), which proposes that low efficacy beliefs (i.e., low perceived response efficacy and/or self-efficacy) motivate individuals to minimize the threat by engaging in potentially maladaptive defensive responses. An important question then is whether optimists' threat minimization in the face of an ineffective preventive action is maladaptive. A potential advantage of threat minimization in this circumstance may be preservation of optimists' favorable beliefs regarding health-related outcomes. Maintenance of such beliefs could be beneficial for the individuals when the situation has changed, e.g., at some later time when they find a recommended action that is effective. In such circumstances, Study 2 obtained evidence that optimists did not downplay a health threat and formed more favorable attitudes toward the preventive action.

Besides disparaging the health threat, did optimists try other ways to directly combat their high RSI risk? Study 2 documented that when the RSI-prevention training was ineffective, optimists at high risk showed higher probability compared to pessimists of subscribing to an email newsletter about RSI prevention, especially when the training was said to be ineffective (although optimists were not different from pessimists in listing

thoughts regarding seeking other preventive measures on the thought-and-feeling measures). These findings suggested that optimists were more likely than pessimists to switch coping strategies when an initial option (i.e., attending the training) was expected to be unhelpful. These results are in line with the findings of Aspinwall and Richter (1999), who demonstrated that dispositional optimists disengaged from unsolvable tasks sooner than their pessimistic peers before redirecting their efforts to more solvable tasks that led to the same goal. We suggest that optimists are responsive to outcome valence of adopting a recommended action to prevent a health threat. If a recommended action is not adequately reassuring, optimists were more likely to disengage and seek an alternative way to manage the health threat.

Optimism's Role in Responding to a Fear-arousing Persuasive Message of Low Personal Relevance

The results of Study 2 suggest that optimists who were at high risk for a serious health threat focused on efficacy of the preventive action, which determined likelihood of successfully managing the threat, in making attitudinal judgments. If accepting an action recommendation increases the likelihood of desirable outcomes, optimism promotes message acceptance. In contrast, if accepting the preventive action does not guarantee desirable outcomes, optimism increases message rejection. This effect was stronger, but not limited to, the circumstance in which individuals were highly susceptible to the health threat.

When a serious health threat was low in personal relevance, optimists' attitudinal judgments were positively influenced by the highly effective training, which suggested an

attempt to actively prevent increased risk for RSI in the future. These results are inconsistent with the findings of Geers et al., 2003, who obtained no moderating effects of optimism under low personal relevance circumstances. It should be noted, however, that our operationalization of low personal relevance was different from Geers and colleagues'. In their study, Geers and colleagues told participants that the new tuition policy (the attitude object) was under review either in the participants' current state (high personal relevance) or in a different state (low personal relevance). Participants in the low personal relevance condition in the study of Geers and colleagues thus would have very low to no chance of experiencing the outcome of the policy implementation. Participants in the low personal relevance condition of our study, however, perceived some chances of experiencing negative health outcomes from RSI, which would explain the significant moderating effects of optimism observed in Study 2. Therefore, our study investigated optimists' responses to fear-arousing information and action recommendations in a low rather than no personal relevance situation. We believe that testing the effects of optimistic beliefs on persuasion regarding health issues that are low in personal relevance mimics real-life situations when people' risk for a health threat can be increased depending on modifiable factors such as their lifestyles. Personal relevance to health problems in such circumstances would be considered low rather than no relevance, as people have at least some chance of experiencing the health problems.

Implications for Optimism's Role in Response to Fear-arousing Persuasive Messages

The findings of Study 2 reveal important theoretical and practical implications when considering the use of fear appeals. On the theoretical side, our findings showed the important role of dispositional optimism in coping with fear-arousing information: optimists accepted a highly effective recommended action for dealing with health threat, indicating approach coping aiming to eliminate the threat, while minimizing the health threat when the recommended action is not helpful, indicating an avoidance coping attempt. The role of optimism discussed here may sound similar to other individual differences found to be associated with coping style, such as monitoring and blunting coping styles, an individual difference in the degree to which people approach or avoid information about threats (Miller, 1987). However, individual differences in optimism and coping style may be distinguished on several grounds. Monitoring and blunting coping styles directly represent coping modes such that monitors tend to approach threatening information (e.g., cancer screening results), while blunters tend to avoid it (see Miller, 1995 for a review). Dispositional optimism, however, is a broader construct that refers to future-oriented beliefs that good rather than bad outcomes are more likely and does not necessarily indicate a specific coping strategy in dealing with threatening information. Dispositionally optimistic (and pessimistic) beliefs also pertain to life in general (as opposed to a specific context; Scheier & Carver, 1992), while the monitoring and blunting coping styles apparently refer to the context of coping with stressors.

On the practical side, findings from Study 2 confirmed the long-known importance of promoting response efficacy in fear-arousing communications (Leventhal,

1970, 1971; Rogers, 1975, 1983; Witte, 1992). As the presentation of a threat is usually aimed to elicit coping attempts, persuasive messages utilizing fear appeals should facilitate approach coping by emphasizing a high chance of success in averting the threat if a recommended action is adopted. We found that when this condition was met, optimistic individuals exhibited more favorable attitudes toward such recommended actions. For persuading pessimists to adopt a health-prevention behavior, the findings of Study 2 suggest that fear appeals may be inappropriate strategies. Although they reported comparable negative affective responses to the health threat to optimists in the high-risk condition, pessimists' attitudes toward the recommended action were not responsive to the manipulated effectiveness of the recommended action. Therefore, presenting a serious health threat to pessimists for the purpose of promoting the adoption of preventive behaviors may not be an effective strategy. What would be a better persuasive strategy for pessimists, however, cannot be concluded from the findings of the present study.

Strengths and Limitations of Study 2

To our knowledge, Study 2 represents the first direct investigation of optimism's moderating effects on people's responses to a fear-arousing communication. Therefore, we have extended research on the role of optimistic belief in persuasion processes and outcomes. To carefully examine the role of optimism, we included measures of both cognitive and affective responses to the fear-arousing information component and the action recommendation component of the persuasive message. This allowed us to

elucidate the pathways through which optimistic beliefs influenced attitudes toward a recommended health-prevention behavior.

Two limitations of Study 2 deserve mention. First, our response efficacy manipulation was not successful in producing the statistically reliable difference in efficacy ratings between the moderate and low efficacy training. However, it should be noted that we obtained evidence suggesting that the moderately and the low effective training conditions produced different responses. For instance, optimists generated greater counterarguments against RSI toward the low effective, but not toward the moderately effective training. Therefore, although participants rated the efficacy of the moderately and low effective training statistically equally, they responded to them differently on our outcome measures. Another limitation of Study 2 is that, like Study 1, we measured rather than manipulated optimism and thus no causal relations between optimism and the outcomes that can be drawn. We do, however, have consistent evidence that the observed effects of optimism were not confounded by four other individual differences related to optimism, namely, neuroticism, self-mastery, trait self-esteem, and trait positive affectivity.

GENERAL DISCUSSION

Theoretical Contributions of the Present Studies

The goal of the present research was to examine the role of optimism in processing of persuasive messages and judgmental outcomes in the context of prevention of illness. We hypothesized that optimistic beliefs about future outcomes would facilitate less defensive processing, resulting in careful processing of health-threatening persuasive information. Our Study 1 results supported this prediction, as optimistic beliefs were associated with greater cognitive elaboration of and lower negative emotional consequences of exposure to self-relevant health-threatening persuasive information. However, optimism appeared to reduce, rather than increase differentiation between strong and weak arguments, while seeming to enhance negative attitudes toward the harmful health behavior. Study 2 found that optimists' attitudes toward a preventive behavior were responsive to the stated effectiveness of the behavior rather than overly positive. This responsiveness is inconsistent with the idea that optimists will accept any recommendation regardless of its quality in order to avoid a serious health threat. As we will describe in subsequent sections, the findings of the present studies provide some support for the valence-enhancement hypothesis (Geers et al., 2003), while suggesting a broader explanation of optimism' role in the attitude change process -- specifically, optimism may enhance attitude change according to valence of the consequences of accepting persuasive messages.

Optimism Promotes Less Defensive Processing of Self-Relevant Health-risk Information

Study 1 demonstrated that optimism facilitates elaborative processing of self-relevant health-threatening persuasive information while buffering negative emotional consequences. We obtained strong support for our hypothesis that optimists would carefully consider self-relevant health-threatening information as optimists reported putting greater effort in processing the persuasive messages and engaged in greater cognitive elaboration of the persuasive message, especially the negative message about the cardiac risks of their caffeine consumption, than did pessimists. In addition, optimists especially generated a greater number of negative thoughts concerning caffeine use after exposure to the negative message than did pessimists. These results are consistent with the findings of Aspinwall and Brunhart (1996, 2000) who documented a beneficial role of optimism in attending to and elaborative processing of self-relevant health-threatening information.

The present studies extend those of Aspinwall and Brunhart by showing that optimists also make attitudinal judgments in less defensive manner and in line with precautions against negative health outcomes. Optimists in Study 1 changed their attitudes regarding their current caffeinated drinks consumption to be somewhat more negative than did pessimists after they were informed that the behavior could cause serious harm. Optimists in Study 2 showed more positive attitudes toward a health-prevention behavior only when it would successfully prevent a serious health threat they were said to be facing. The results show that optimists acknowledge that they might be

in danger and make attitudinal judgments in such a way as to reduce negative future outcomes.

When presented with an ineffective preventive measure, however, optimists in Study 2 downplayed the health threat to a greater extent than did pessimists when their risk was high, indicating a defensive response. These findings contradict numerous studies that uniformly documented that optimism was associated with less avoidance coping with health threats, as well as other kinds of stressors (e.g., Aspinwall & Brunhart, 1996, 2000; Aspinwall & Taylor, 1992; Carver et al., 1993; see Solberg Nes & Segerstrom, 2006 for a review), and they are also inconsistent with the findings of Study 1. How, then, do we reconcile the contradicting evidence concerning optimists' defensive response to health threat? Are there specific situations in which optimists would respond defensively to health threats? We consider these issues in the next section.

Does Optimism Promote Less or More Defensiveness in Handling Serious Health Threats?

A key factor that contributes to optimists' defensive responses to self-relevant health threat, we believe, is the availability of an effective prevention measure. When a recommended health behavior is effective in avoiding the health threat (e.g., reduction of caffeine use in Study 1 and the highly effective RSI-prevention training in Study 2), optimists' responsiveness to the valence of future outcomes might inform them that adoption of the behavior possess a high chance of yielding positive coping outcomes. As a result, optimists might be less defensive and agree more with the recommendation to

cut down their caffeine consumption and to participate in the highly-effective RSI-prevention training. However, in the face of an unhelpful recommendation (ineffective training in Study 2), optimists' responsiveness to valence of future outcomes might inform them that managing the health threat by adopting an ineffective preventive action is unlikely to yield a positive outcome, and thus a different strategy is needed. Minimization of the health threat to appear less likely, on the other hand, would yield a positive coping result, at least in the short term, as it directly reduces perceived threat. Optimists' counterarguing against a health threat in an absence of effective prevention method, we believe, might reflect their coping flexibility as a function of the likelihood of good coping outcomes, and could potentially be adaptive. Minimization of health threat when prevention is feasible, instead, would be considered more clearly maladaptive.

Research on self-regulation indicates that disengagement from unattainable goals is an adaptive and necessary component of effective self-regulation (e.g., Wrosch, Scheier, Carver, & Schulz, 2003) as it could save a person from potential coping failures while freeing up personal resources (e.g., time, effort, and possibly individuals' optimistic beliefs) for investing in other more attainable goals. Supporting this idea, studies have documented beneficial effects of goal disengagement in lowering stress and depression, as well as increasing self-mastery (Wrosch, Scheier, Miller, Schulz, & Carver, 2003), which led to increased subjective well-being (Heckhausen, Wrosch, & Fleeson, 2001). Optimists' disengagement from preventing the RSI health threat in the presence of the ineffective prevention method in Study 2 may allow reallocation of coping resources to other available means to prevent the health threat. Consistent with this idea, we found that optimists at risk for RSI seemed to re-engage in the prevention

goal by showing higher probability of subscription to an RSI email newsletter as an alternative to the ineffective prevention training, as compared to pessimists. It should be noted that in practice, the presentation of ineffective prevention recommendations is unlikely, as the general consensus in the fear appeal literature is that efficacy enhancement is crucial to success of the health-risk communication (Leventhal, 1970, 1971; Rogers, 1975; Witte, 1992). Testing a fear appeal with low response-efficacy recommendation as in Study 2, however, provides better understanding of how optimists deal with health threats in such a circumstance.

Optimists Did Not Uncritically Accept Favorable Persuasive Health Information

Potential liabilities of holding a rosy outlook on life may not only involve avoidance of useful negative information (which has been disconfirmed by our data), but also approaching positive information uncritically, which could lead to detrimental consequences. For example, in Study 1 accepting the positive message encouraging caffeine use for the benefit of heart health could lead to other negative health consequences. The valence-enhancement hypothesis predicts that optimistic beliefs will enhance favorable attitudes toward positively-framed messages. The present studies extend this prediction by showing that optimists do not simply respond to the positive tone of message. Instead, they seem to process positive information about health behavior carefully enough to assess likelihood of positive outcomes of accepting the recommended behavior, although doing so may involve incorporating negative information concerning the behavior from their knowledge (i.e., about caffeine use in

Study 1). Instead of being more confident about the healthfulness of their caffeine consumption, optimists were more likely than pessimists to question the strong evidence suggesting significant benefits of caffeine use and did not show enhanced subsequent positive attitudes toward caffeine use. Similarly, when the positive results of the RSI-prevention training were not clearly guaranteed (i.e., in cases of the moderate- and low-efficacy training), the enhancing effect of optimistic beliefs on attitudes toward the training was less pronounced or not observed.

Based on our results, optimists appear to have considered and evaluated positive information about health behaviors cautiously. Doing so may promote health benefits via decreased chance of potential negative outcomes and increased chance of positive outcomes from adopting health behaviors.

The Outcome Valence-enhancement Hypothesis: A Proposed Extension of the Valence-enhancement Hypothesis

The findings from the present studies advance knowledge concerning optimism's moderations of attitude change processes and outcomes. The results extend the valence-enhancement hypothesis of Geers et al. (2003) by showing that under conditions of high personal relevance, optimistic belief not only promotes focusing on valence of persuasive messages, but also increases responsiveness to the valence of the likely health outcomes associated with message acceptance. We, therefore, propose an extension of the valence-enhancement hypothesis: optimistic expectations about future outcomes motivate individuals to focus on likelihood of attaining positive and negative outcomes associated with attitude objects. Under high personal relevance circumstances in which the likely

outcomes of attitude and corresponding behavioral changes have strong impacts on individuals, dispositional optimism will enhance positive attitudes toward attitude objects that are linked to positive outcomes, but will enhance negative attitudes toward attitude objects that are associated with negative outcomes. Our predictions are broader in scope than the original valence-enhancement hypothesis, which predicts the enhancement effects of optimism on valence of message framing (positive vs. negative) such that optimism will enhance positive attitudes toward an attitude object that is presented positively but will enhance negative attitudes toward the object when it is presented negatively,

A good example of the difference between valence of persuasive message and valence of outcomes associated with accepting the message is the case of positive message about caffeine consumption used in our study. The valence of the message is positive as it presents a positive attribute of caffeine consumption—improved heart health. However, the valence of the outcomes if the attitude position is accepted, as we argue, may not be entirely positive as caffeine use can also have negative effects on health. If optimists merely respond to the positive tone of the message, their attitudes toward caffeine use should be more favorable than pessimists'. However, if optimists are responsive to valence of outcomes of the consumption, their attitude should be slightly more positive than pessimists' because the message adds more weight to the pro side, but does not remove the cons of caffeine consumption. Our results are more consistent with the latter prediction, providing support for the outcome valence-enhancement hypothesis.

Under low personal relevance, the valence-enhancement hypothesis predicts no effect of optimism, while we obtained significant moderating effects of optimism in the

low risk circumstance in Study 2. A possible explanation presented earlier is that our manipulated level of low personal relevance might be higher than that in the study of Geers et al. The role of dispositional optimism in attitude change under low personal relevance thus needs further investigation. Based on previous research (Abele & Gendolla, 2007; Aspinwall & Brunhart, 1996, 2000; Geers et al., 2003), it seems reasonable to expect that optimistic beliefs would not enhance responsiveness to valence of outcomes when personal relevance is low. In such circumstances, the positivity and negativity of outcomes associated with message acceptance would have a weak impact on individuals.

Optimists' Lower Negative Affective Responses to Health Threat May Signify Lower Threat Perception

What did optimists' affective responses to the health threats tell us about optimists' defensive responses to health-threatening information? The results from our studies suggest that optimists do not react emotionally to health threats in a defensive way. Optimists at high risk for a health threat in Study 2 did not differ from pessimists in their negative affective response to RSI health threat. Regardless of the manipulated risk and response efficacy, optimists reported more positive affect in response to the recommended preventive action following fear-arousing information about a health threat as compared to pessimists. These results suggest that optimists' affective responses to health threat do not indicate a tendency to reject or avoid dealing with health threat.

In what situations, then, would optimistic beliefs buffer against unpleasant emotional consequences of exposure to self-relevant health-threatening information? We

found that optimists in Study 1 exhibited lower negative affective responses to the serious harm of caffeine use as compared to pessimists. Less negative affective responses in turn were linked to more positive attitudes toward the health threat (although these positive attitudes were more than offset by the negative attitudes predicted by the negative cognitive responses to the message). Optimists in Study 2 also showed lower negative affective responses to the RSI health threat when their risk was low. These findings imply that optimists' lower negative affective responses to health threats might be a result of their lower perception of threat. This interpretation is in line with the finding that optimists' emotional responses to threatening information were at least partly due to belief in greater coping resources for successfully handling the threat (Kaiser et al., 2004). Optimists in Study 1 might be confident that they can manage to avoid seriously negative side effects and obtain benefits from caffeine use (e.g., increased alertness).

The significant mediating role of optimists' affective response to health threat in Study 1 supports previous research that highlighted the importance of affective responses to persuasive messages in determining attitude change (Rosselli et al., 1995; Zuwerink & Devine, 1996), although in our study, optimists' cognitive responses to the message were found to be more powerful predictors of attitude. Our study extends the previous findings by demonstrating that affective responses to persuasive messages can be linked to attitude change in a way that contradicts cognitive responses. Interestingly, compared to the results of Study 1, the failure of affective responses to explain attitude change in Study 2 implies that such responses might be more important when optimists have prior knowledge or existing attitudes toward the stimuli. Future research is thus necessary for clarifying the role of affective responses to persuasive message in attitude change.

Optimism Did Not Predict Intentions to Change Health-related Behaviors

While it predicted postmessage attitudes toward caffeine use and the recommended preventive action, dispositional optimism was not related to behavioral intentions in either study. A possible explanation is mismatch in level of specificity of the predictor and the outcome such that dispositional optimism construct, representing generalized outcome expectancies, was at a different level of specificity as intentions to change a health behavior which involve a specific plan to do so. Previous studies suggest that situational optimism is a better predictor of some situation-specific outcomes than is dispositional optimism (Aspinwall & Brunhart, 1996; Scheier et al., 1989; Segerstrom, Taylor, Kemeny, & Fahey, 1998; Taylor et al., 1992), possibly due to greater match in level of measurement between domain-specific optimism and the predicted outcomes. Thus, it is possible that a more specific optimistic belief such as health-specific optimism or optimism specific to changing caffeine consumption behavior and participating in the RSI-prevention training might be a better predictor of the corresponding intentions, as compared to generalized optimism.

Another explanation of the failure of dispositional optimism in predicting intentions in the current studies involves an influence of other factors such as goal prioritization. Recent studies have found that optimists' engagement in health-promoting activities (e.g., attending a nutrition education program) was determined by importance they assigned to the goal of attendance (Geers, Wellman, & Lassiter, 2009; Geers, Wellman, Seligman, Wuyek, & Neff, 2010). Geers et al. (2010) offered college students three weekly psychotherapy sessions to address academic problems and found that

dispositional optimists showed higher rates of attendance than did pessimists only when they believed that attending the session could aid them in achieving important personal goals. The authors reasoned that optimistic individuals were more likely to invest resources in valuable goals because consequences of success and failure were more pronounced. According to this idea, it is possible that optimists in our studies, all busy university students, did not view some health-related goals as pressing. However, because goal importance or goal prioritization was not assessed in the present studies, we cannot test this possibility.

Moderating Effects of Optimism Were Not Explained by Other Individual Differences

Although dispositional optimism was measured, instead of manipulated, the present studies obtained no evidence that the results for dispositional optimism could be attributed to neuroticism, trait self-esteem, trait positive affectivity, self-mastery, or naïve optimism. In Study 1, most of results concerning dispositional optimism remained significant when neuroticism, trait self-esteem, trait positive affectivity, or self-mastery were statistically controlled. Naïve optimism, the tendency to overgeneralize the implications of positive events without thoroughly considering reality (Epstein, 1998), however, seemed to alter the pattern of relationships among dispositional optimism, message valence, and argument strength and postmessage attitudes toward caffeine use. It should be noted that the interactive effect of naïve optimism and message valence did not produce the patterns of relationship with attitudes toward caffeine use observed for dispositional optimism. In Study 2, none of the other individual differences, namely,

neuroticism, trait self-esteem, trait positive affectivity, and self-mastery, was found to be responsible for the predictive effects of dispositional optimism in predicting the attitudes toward the RSI-prevention training.

Overall, consistent with previous studies that distinguished optimism from other relevant constructs (Aspinwall & Brunhart, 2000; Aspinwall & Richter, 1999; Bryant & Cvengros, 2004; Chang, Maydeu-Olivares, & D'Zurilla; 1997; Geers et al., 2003; Scheier et al., 1994), the present studies were fairly successful in ruling out potential confounds of dispositional optimism, and thus provide evidence for the uniqueness of the construct in predicting outcomes related to attitude change following a persuasive communication about health.

Implications for Research Concerning Adaptiveness of Optimistic Beliefs

The current studies add an important understanding of how optimists may cope with potential health threats and ultimately reap health benefits. Specifically, instead of responding defensively, optimists may endeavor to prevent potential health threats by 1) elaborately processing the health-threatening persuasive message; 2) adopting enhanced negative attitudes toward health behaviors that lead to negative outcomes and showing enhanced positive attitudes toward health behaviors that lead to positive outcomes; and 3) seeking useful health-prevention information necessary for managing health threats. These findings are in line with the research documenting that optimists actively protect their health by attending to, elaborating, and remembering self-relevant health-risk information (Abele & Gendolla, 2007; Aspinwall & Brunhart, 1996; 2000) and adopting

healthy lifestyles and various kinds of health-enhancing behavior (e.g., exercise) to a greater extent than do pessimists (Robbins, Spence, & Clark, 1991; Steptoe, Wardle, Vinck, Tuomisto, Holte, & Wichstrom, 1994; see Aspinwall & Tedeschi, 2010, for a review).

The findings of the present studies may also inform the debate regarding the benefits of optimistic beliefs, namely, whether such beliefs are associated with adaptive psychological adjustments to adversity. Specifically, Taylor and Brown (1988, 1994) proposed that "positive illusions," consisting of unrealistically optimistic beliefs about future outcomes, beliefs in personal control over events, and overly favorable self-evaluations, are essential in promoting psychological well-being and successful adaptation to stressful events and illnesses. Contrary to this framework, accurate perceptions of stimulus events and one's social surroundings have instead been argued to be necessary for mentally healthy individuals (see Baumeister, 1989; Colvin & Block, 1994). The key point of this latter argument is that people with positive illusions may ignore negative information (e.g., health-threatening information) because it challenges their beliefs, resulting in maladaptive adjustment as people do not respond to stressors and negative life events based on reality. The present data suggest that optimistic beliefs may be adaptive rather than maladaptive. Using both participants' own health behaviors and experimental manipulations of risk for serious illness, we obtained evidence that optimistic belief facilitated processing and using health-threatening information in making decisions to protect one's health when an effective preventive measure was available.

Directions for Future Research

The findings of the present studies concerning the role of optimism in responding to and using valenced health-related persuasive information in making attitudinal judgments provide important implications for how optimism may be related to health benefits. Future research may benefit from testing the outcome valence-enhancement hypothesis proposed here in order to replicate our findings. It would also be important to examine whether the results observed in the present studies are specific to persuasion in the health domain in which benefits associated with optimism have been consistently observed. Interestingly, dispositional optimists have been found to show attentional bias by taking a longer time to name colors of well-being related stimuli (words such as "longevity" "happiness") in comparison to threat-related (e.g., disaster, danger) and neutral words (e.g., tree, couch) in an emotional Stroop task (Karademas, Kafetsios, & Sideridis, 2007), indicating a possibility that optimists might respond to health-related stimuli (e.g., persuasive messages) differently from other kinds of stimuli. Whether or not optimists respond to information about health differently from other kinds of information thus would benefit from future investigation.

As Study 2 is the first to demonstrate optimists' derogation of health threat when a preventive action was not likely to be effective, future research is therefore necessary to examine if this finding holds true in different contexts of persuasion. Although optimism has been consistently associated with increased use of approach coping aimed to actively eliminate stressors and decreased use of avoidance coping (see Solberg Nes & Segerstrom, 2006; Taylor & Aspinwall, 1996 for reviews), optimists have shown flexibility in dealing with adversity, such as by employing both problem-focused and

emotion-focused coping (e.g., seeking support from others; Aspinwall & Taylor, 1992; Dougall, Hyman, Hayward, McFeeley, & Baum, 2001). It is possible that optimists' active approach-oriented coping may enhance their experiences and skills in selecting coping strategies that that would maximize coping success according to features of situations. Investigation of optimists' use of avoidance coping strategies would enhance understanding of mechanisms through which optimism may promote better outcomes in adjustment to particular kinds of adversity.

Further investigation should also benefit from examining whether manipulated optimism yields the same results as measured optimism. Some researchers (e.g., Fosnaugh, Geers, & Wellman, 2009) have proposed methods to experimentally manipulate optimism in the laboratory setting. Successful manipulations of optimistic and pessimistic beliefs would be beneficial in increasing understanding of the pathways by which optimism is associated with adaptive adjustment to adversity. Future research may benefit from investigating whether experimental manipulations of future outcome expectancies would have similar effects as a lifetime of optimistic beliefs. For instance, one could examine whether manipulated optimistic expectancies promote a greater focus on potential outcomes of a recommended health-prevention behavior in the same way as documented by the present studies. It should be noted, however, that the pathway between positive outcome expectancies and successful coping with health threat requires coping skills and knowledge (see Aspinwall et al., 2001 for a review), for instance, in the assessment of the likelihood of a particular coping outcome and the adoption of appropriate strategies for handling a specific stressor. If these skills and knowledge are acquired through optimists' experiences of coping with various kinds of stressful

situations, manipulated optimistic belief may not yield similar outcomes in adjustment as measured optimism. Future research should investigate whether this idea holds true.

Conclusion

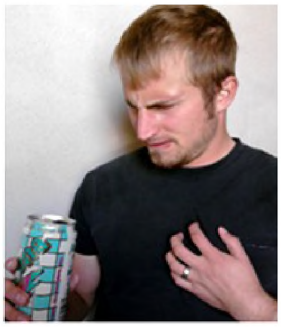
The present studies demonstrate that optimistic beliefs play a significant role in processing and making judgments regarding attitude and behavioral change in the domain of health. While there is evidence that optimists attended to and processed health-threatening information elaborately, indicating less defensive responses (Aspinwall & Brunhart, 2000), research on the role of optimism in persuasion indicated that optimists' attitude change was not influenced by the quality of valenced persuasive messages (Geers et al., 2003). By testing optimism's role in attitude change regarding health behaviors, our findings increase understanding of the way optimists cope with health threats via message elaboration, affective responses, and attitude change. Our proposed outcome valence-enhancement hypothesis is derived from the findings that optimists processed health-threatening persuasive messages elaborately, but their focus seemed to be on the valence of the likely outcome of accepting the recommended health behavior rather than the strength or quality of the message. The findings that optimists cope with a health threat by enhancing negative attitudes toward a health behavior associated with the threat, and enhancing positive attitudes toward a health behavior that can avert the threat, indicate a possible pathway by which optimistic beliefs have been linked to positive health outcomes.

APPENDIX A

EXAMPLE OF PERSUASIVE MESSAGES IN STUDY 1

1. Negative message

New Evidence That Caffeine May Cause Abnormality of Heart Valve Functioning



*W*ith the increasing popularity of coffee drinks, tea, energy drinks, and soda in the United States, there has been an increasing amount of attention focused on the health consequences of caffeine consumption. Although caffeine makes us think more clearly and work harder, recent research found that caffeine may lead to an important harmful effect on health: abnormalities in heart valve function. Dr. Raymond Martin, M.D. from University of Pennsylvania explains that when something (e.g., effects of caffeine) causes heart valves not to open and close properly, the blood cannot pass from one chamber to another. As the flow is obstructed, it causes the heart to work harder in order to push blood through. This can cause major health complications such as fatigue, palpitations, and chest pain, as well as congestive heart failure. In acute cases, consequences may be sudden and severe -- patients may go into heart failure and require urgent medical treatment.

Three new studies recently examined the link between caffeinated drink consumption and heart valve malfunction.

In February 2008, a researcher at the University of Buffalo, Kathleen Major, reported a link between caffeine and an abnormality of heart valve function among 15 healthy adults (average age 34). The study suggested that high consumption of caffeine (coffee, energy drink, tea, and soda) was associated with self-reported instances of abnormal heart rhythm. This condition is related to the malfunction of heart valves. However, this study has many limitations. For instance, most of the participants are 30 years old and older who might already have undiagnosed heart problem(s).

The second study used 25 male and 13 female participants, age 18 to 65 years old. After participants consumed 2 servings of coffee, a measurement of the participants' heart rate was taken every hour throughout the day. The researchers, James Kalus and Cynthia Smith from the University of Missouri, did not find a significant difference in any indication of abnormal heart valve functions between participants who consumed and did not consume coffee. However, they reported a trend in the data indicating that the coffee-consuming group showed slightly greater frequency of abnormal heart beats.

The third study came out in March 2009. Dr. Martin from the University of Pennsylvania followed 10 healthy caffeine consumers for 3 weeks. The participants (aged 21-55 years old) reported consuming 1-5 servings of caffeinated drinks (coffee, tea, soda, and energy drinks) daily. Dr. Martin found that the consumption of caffeine was associated with participants' report of increased nervousness and abnormal heart rhythm (although caffeine consumption had a rather weak relationship with the increased abnormal heart rhythm). Dr. Martin indicated that caffeine, which affects heartbeat and muscle contractions, might harm heart valve functioning by making the heart pump irregularly. The unusual rapid and irregular heart rhythms then cause problems in the closing and opening of the heart valves. Although the study had a very small number of participants, Dr. Martin believes that it might be enough evidence in suggesting that caffeine could cause heart valve malfunctioning.

From this research data, it seems reasonable to be careful in consuming caffeine. However, Dr. Martin reminds us that caffeine can also lead to better mood, less fatigue, better physical performance, and increased attentiveness. "Caffeine may do some good for us. But these new research findings on heart valves are very interesting. If caffeine comes with damages to my heart, I don't think it's worth it," says Dr. Martin.

2. Positive message

New Evidence That Caffeine May Improve Heart Valve Functioning

*W*ith the increasing popularity of coffee drinks, tea, energy drinks, and soda in the United States, there has been an increasing amount of attention focused on the health consequences of caffeine consumption. Although caffeine can cause restlessness and addiction, recent research found that caffeine may have a surprising, important health benefit: improving heart valve functioning. Dr. Raymond Martin, M.D. from University of Pennsylvania explains that when something (e.g., effects of caffeine) causes the heart valves to open and close more tightly, the blood can pass more smoothly from one chamber to another. As the flow is facilitated, the heart

works more effectively. This can lead to many health benefits such as more vitality, less fatigue, and a lowered chance for chest pain and congestive heart failure. Heart valve function is important such that if the valves don't work properly, consequences may be sudden and severe -- patients may go into heart failure and require urgent medical treatment.

Three new studies recently examined the link between caffeinated drink consumption and improved heart valve function.

In February 2008, a researcher at the University of Buffalo, Kathleen Major, reported a link between caffeine and improved heart valve function among 283 healthy adults (average age 23). The study found that high consumption of caffeine (coffee, energy drinks, tea, and soda) significantly predicted stronger heart rhythm (meaning that the heart pumped more blood with every beat) which might support the functions of heart valves. This study has many strengths. For instance, it takes into account participants' health behaviors that may influence their heart health other than caffeine (other possible causes of the changed heart condition have been ruled out).

The second study used 175 male and 176 female participants, ages 18 to 27 years old. After participants consumed 2 servings of coffee, a measurement of the participants' heart rate was taken every hour throughout the day. The researchers, James Kalus and Cynthia Smith from the University of Missouri, found that the coffee-consuming group showed a significantly greater frequency of strong heart beats as compared to the control group who did not consume coffee. A strong heart beat was related to better heart valve function.

The third study came out in March 2009. Dr. Martin from the University of Pennsylvania followed 212 healthy caffeine consumers for 3 weeks. The participants (aged 21-30 years old) reported consuming 1-5 servings of caffeinated drinks (coffee, tea, soda, and energy drinks) daily. Dr. Martin found that the consumption of caffeine led to increased heart rate and strength of heart contractions (it should be noted that caffeine consumption was a very strong predictor of the increased strength of heart contractions) in participants. Dr. Martin indicated that caffeine, which affects heartbeat and muscle contractions, might help support the functioning of heart valves by making the heart pump with more strength. Strong heart contractions help the heart valves open and close tightly and consistently. Because the study had a very large number of participants, Dr. Martin believes that it may be strong evidence in suggesting that caffeine could improve heart valve functioning.

From this research data, it seems reasonable to feel good about consuming caffeine. Dr. Martin recommends that it's fine to consume caffeine. "From the research evidence we have, I believe that caffeinated drinks have some benefits. Caffeine may not be our best friend, but if it comes with a benefit to my heart, I think it's worth a try," says Dr. Martin.

APPENDIX B

FREQUENCIES OF COGNITIVE AND AFFECTIVE

RESPONSES TO CAFFEINE CONSUMPTION

Table 8

Coding Categories for Cognitive Responses to the Persuasive Messages About Caffeine Consumption

Category	Description	% of Total Thought
1. Positive thoughts regarding caffeine use	Thoughts indicating positive beliefs or attitudes toward caffeine or caffeine use (e.g., "*I felt better about drinking coffee every morning*")	16.16
2. Negative thoughts regarding caffeine use	Thoughts indicating negative beliefs or attitudes toward caffeine or caffeine use (e.g., "*Caffeine can only damage your body*")	48.02
3. Thoughts in support of the research evidence	Thoughts indicating agreement or support the research evidence on the effects of caffeine (e.g., "*I appreciated the mention that confounding variables were accounted for in the description of the study*")	2.22
4. Thoughts criticizing the research evidence	Thoughts indicating disagreement with or criticism of the research evidence on the effects of caffeine (e.g., "*The sample groups were too small and biased to find any useful evidence*")	11.73

Table 8 (*continued*)

Category	Description	% of Total Thought
5. Defensive thoughts	Thoughts indicating defensive responses to the passage, including defensive avoidance, denial, and reactance (e.g., "*I didn't really want to believe the article because I consume at least two caffeinated beverages per day and would like for that not to affect my heart*")	2.69
6. Desire for more information	Thoughts indicating desire for further information and clarification (e.g., "*Wanting to learn more about how it is good for your health*")	13.95
7. Unrelated thoughts	Thoughts unrelated to the topic (e.g., "*I am wondering if the researcher drinks coffee*")	5.23
	Total	100

Table 9

Coding Categories for Affective Responses to the Persuasive Messages About Caffeine Consumption

Category	Description	% of Total Feelings
1. Positive affective response	Thoughts and single words that describes positive feelings (e.g., "*I feel calm*", "*happy*")	29.37
2. Negative affective response	Thoughts and single words indicating negative feelings (e.g., "*I'm worried about my risk [for heart valve malfunction]*", "*anxious*")	46.03
3. Neutral affective response	Thoughts and single words indicating neutral feelings (e.g., "*I feel neutral*", "*surprised*").	24.60
	Total	100

APPENDIX C

FEAR-AROUSING INFORMATION ABOUT RSI

Repetitive Strain Injury: A New Health Threat to College Students

What is Repetitive Strain Injury (RSI)?

Repetitive Strain Injury (RSI) is injury to muscles, tendons, and nerves or soft tissue injuries like the nerve spasms, trigger finger and carpal tunnel syndrome. RSIs are caused by overusing limbs such as hands, wrists, shoulders, and neck to perform a repetitive task, such as typing, writing, or clicking a mouse or other forceful activities that put your body in awkward postures. Anyone who sits in the same position for a long time regularly such as working on a computer for more than few hours a day, using musical instruments, texting on cell phone frequently or for a long time, or playing video games for long hours is at risk of Repetitive Strain Injury. That is why other than adults in working age, RSI have been found to be a new threat for college students, and doesn't just affect working adults. Dr. Susan Rogers from University of Massachusetts expresses worry about texting behavior of college students. "We already know that college students use computers a lot. There is also a new research finding that frequent texting on your mobile phones can be harmful to your thumbs because the thumb is the least dexterous of all our fingers. It is not suited to the repetitive movements required to type on a cell phone keypad. Almost everybody uses SMS these days, so no doubt that RSI has become a new concern among teenagers."

What are symptoms of Repetitive Strain Injury (RSI)?

Repetitive Strain Injury is cumulative and occurs as a slow process. Common symptoms of RSI are chronic pain in the upper back, shoulders, or neck associated with using the computer, possibly up to burning sensation in the hands, wrists, fingers, forearms, or elbows, tingling, and paralyzed feelings. When muscles are overworked, the tendons can become inflamed and sore. The inflamed muscles and tendons can constrict the nerves causing them to degenerate and die and that leads to permanent loss of muscle and motor functions. This means people suffering with RSI may eventually unable to use their hands or arms, as a result of overusing these limbs (e.g., on computer mouse and keyboard).

Therefore, the Repetitive Strain Injury is very serious as it can cause pain and disability and may lead to permanent incapacity. Unfortunately, most people tend to not realize that their body positions and the way they habitually use their organs in routine work or favorite activities can slowly and cumulatively cause RSI. Once they occur, RSI-related health problems are typically difficult to treat. Therefore, prevention is the best way to stop RSI.

APPENDIX D

RSI DIAGNOSTIC RESULTS

Repetitive Strain Injury Diagnostic Summary

Patient 00581

Test Performed by SHS-35735

RSI Diagnosis

AT RISK OF REPETITIVE STRAIN INJURY

RSI Diagnosis was based on the following factors:

REPETITIVE USES OF LIMBS/SIGNS OF PRE-RSI

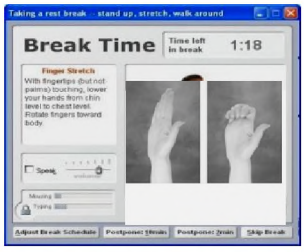
APPENDIX E

MANIPULATION OF RESPONSE EFFICACY

Hey U, Let's Take a Break

Due to the higher rate of students reporting signs of Repetitive Strain Injury (RSI) in the University of Utah (data collected during the year 2006-2009 via the Student Health Center and University Hospital), the University of Utah Alumni Association has introduced a program called Take a Break training aimed to provide students at the University of Utah with information about how to prevent the development of RSI. The program will be offered to students and staffs of the university.

How does the program work?



Participants will receive important information about RSI, including its symptoms and their seriousness. Participants will receive training on how to use a computer mouse, keyboard, and laptop computers in a proper manner in order to avoid typing injuries and how to use a software BreakZ® (download free on the internet) to help prevent overuse of muscles during long periods of working and repetitive movements of important limbs, such as hands, shoulder, and arms.

Want to join?

The RSI-prevention training is offered free-of-charge to students and staffs of the University of Utah. Students interested in participating can sign up online at www.alumni.utah.edu/events/takeabreak.html. They will be required to enter their UNID and password. The training will be provided at the Student Union building starting next month. The whole training will take about 1.5-2 hours.

FYI: Reports from few other universities that have already provided this RSI-prevention training to their students indicate that about **88% (50%, 12%)** of students who participated in the training showed decreased risk of RSI afterward. They also reported greater knowledge of how to use their limbs in the way that was safe for them.

Contact us

For more information, contact Vanessa Browning, the program coordinator at 801-581-6994 between 9 a.m. and 6 p.m.

APPENDIX F

FREQUENCIES OF COGNITIVE AND AFFECTIVE

RESPONSES TO RSI

Table 10

Coding Categories for Cognitive Responses to the Fear-arousing Information About RSI

Category	Description	% of Total Thought
1. Positive thoughts about RSI health threat	Positive thoughts or thoughts in agreement with the information about RSI health threat (“*The information is helpful”)*	24.22
2. Negative thoughts about RSI health threat	Thoughts counterarguing the information about RSI health threat, including defensive responses to the passage, including defensive avoidance, denial, and reactance (“*I think RSI is kind of silly because it’s something that is resolved by common sense*”)	16.55
3. Thoughts about high risk and severity of RSI	Thoughts indicating perceptions of high risk and severity of RSI (“*I knew I would probably be at high risk for RSI*”)	25.42
4. Thoughts about low risk and severity of RSI	Thoughts indicating perceptions of low risk and severity of RSI (“*My work is hands on so I really do not consider myself at risk*”)	6.95
5. Thoughts about desire to reduce RSI risk	Thoughts indicating desire to reduce RSI risk (“*If it is a slow process, it is important to use prevention now*”)	15.83

Table 10 (*continued*)

Category	Description	% of Total Thought
6. Desire for more information	Thoughts indicating desire for further information ("*I should probably learn more*")	9.11
7. Unrelated thoughts	Thoughts unrelated to the topic (e.g., " *my eyes hurt*")	1.92
	Total	100

Table 11

Coding Categories for Affective Responses to the Fear-arousing Information About RSI

Category	Description	% of Total Feelings
1. Positive affective response	Thoughts and single words that describes positive feelings (e.g., "*relieved*", "*mildly interested*")	38.27
2. Negative affective response	Thoughts and single words indicating negative feelings (e.g., "*irritated*", "*a little concerned*")	47.45
3. Neutral affective response	Thoughts and single words indicating neutral feelings (e.g., "*neutral*", "*unsurprised*").	14.28
	Total	100

APPENDIX G

FREQUENCIES OF COGNITIVE AND AFFECTIVE

RESPONSES TO RSI-PREVENTION TRAINING

Table 12

Coding Categories for Cognitive Responses to the Information About RSI-prevention Training

Category	Description	% of Total Thought
1. Positive thoughts regarding the RSI-prevention training	Thoughts indicating positive beliefs regarding the RSI-prevention training ("*I think the recovery program would be good to help people become aware of a potential problem with RSI*")	47.15
2. Negative thoughts regarding the RSI-prevention training	Thoughts indicating negative beliefs regarding the RSI-prevention training ("*I thought that the 12% benefit was a little low*")	29.08
3. Thoughts about desire to prevent RSI	Thoughts indicating desire or intention to prevent RSI ("*I need to prevent any further risk*")	6.09
4. Thoughts indicating desire for more information	Thoughts indicating desire for more information about the RSI-prevention training ("*I want to learn more*"),	10.41

Table 12 (*continued*)

Category	Description	% of Total Thought
5. Unrelated thoughts	Thoughts unrelated to the topic (e.g., "*The color yellow [of the flyer] is not great*")	7.27
	Total	100

Table 13

Coding Categories for Affective Response to the Information About RSI-prevention Training

Category	Description	% of Total Feelings
1. Positive affective response	Thoughts and single words that describes positive feelings (e.g., "*excited*", "*informed*")	51.87
2. Negative affective response	Thoughts and single words indicating negative feelings (e.g., "*unsure*", "*annoyed*")	40.11
3. Neutral affective response	Thoughts and single words indicating neutral feelings (e.g., "*curious", "neutral"*)	8.02
	Total	100

REFERENCES

Abele, A. E., & Gendolla, G. H. E. (2007). Individual differences in optimism predict the recall of personally relevant information. *Personality and Individual Differences, 43,* 1125-1135.

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions.* Newbury Park, CA: Sage.

Aspinwall, L. G., & Brunhart, S. M. (1996). Distinguishing optimism from denial: Optimistic beliefs predict attention to health threats. *Personality and Social Psychology Bulletin, 22,* 993-1003.

Aspinwall, L. G., & Brunhart, S. M. (2000). What I do know won't hurt me: Optimism, attention to negative information, coping, and health. In J. E. Gillham (Ed.), *The science of optimism and hope: Research essays in honor of Martin E. P. Seligman* (pp. 163-200). Philadelphia: Templeton Foundation Press.

Aspinwall, L. G., & Richter, L. (1999). Optimism and self-mastery predict more rapid disengagement from unsolvable tasks in the presence of alternatives. *Motivation and Emotion, 23,* 221-245.

Aspinwall, L. G., Richter, L., & Hoffman, R. R. (2001). Understanding how optimism works: An examination of optimists' adaptive moderation of belief and behavior. In E. C. Chang (Ed.) *Optimism and pessimism: Implication for theory, research, and practice* (pp. 217-238). Washington, DC: American Psychological Association.

Aspinwall, L. G., & Taylor, S. E. (1992). Modeling cognitive adaptation: A longitudinal investigation of the impact of individual differences and coping on college adjustment and performance. *Journal of Personality and Social Psychology, 63,* 989-1003.

Aspinwall, L. G., & Taylor, S. E. (1997). A stitch in time: Self-regulation and proactive coping. *Psychological Bulletin, 121,* 417-436.

Aspinwall, L. G., & Tedeschi, R.G. (2010). The value of positive psychology for health psychology: Progress and pitfalls in examining the relation of positive phenomena to health. *Annals of Behavioral Medicine, 39,* 4-15.

Baumeister, R. F. (1989). The optimal margin of illusion. *Journal of Social and Clinical Psychology, 8,* 176-189.

Benyamini, Y., & Roziner, I. (2008). The predictive validity of optimism and affectivity in a longitudinal study of older adults. *Personality and Individual Differences, 44,* 853-864.

Bower, G. H. (1981). Mood and memory. *American Psychologist, 36*, 129-148.

Bower, G. H., & Forgas, J. P. (2001). Mood and social memory. In J. P. Forgas (Ed.), *The handbook of affect and social cognition* (pp. 95-120). Mahwah, NJ: Lawrence Erlbaum.

Brissette, I., Scheier, M. F., & Carver, C. S. (2002). The role of optimism and social network development, coping, and psychological adjustment during a life transition. *Journal of Personality and Social Psychology, 82,* 102-111.

Bryant, F. B., & Cvengros, J. A. (2004). Distinguishing hope and optimism: Two sides of a coin, or two separate coins? *Journal of Social and Clinical Psychology, 23,* 273-302.

Cacioppo, J. T., & Petty, R. E. (1981). Social psychological procedures for cognitive response assessment: The thought-listing technique. In T. V. Merluzzi, C. R., Glass, & M. Genest (Eds.), *Cognitive assessment* (pp. 309-342). New York: Guilford Press.

Carver, C. S., Pozo, C., Harris, S. D., Noriega, V., Scheier, M. F., Robinson, D. S., … Clark, K. C. (1993). How coping mediates the effect of optimism on distress: A study of women with early stage breast cancer. *Journal of Personality and Social Psychology, 65*, 375-390.

Chaiken, S. (1980). Heuristic versus systematic information processing and the use of source versus message cues in persuasion. *Journal of Personality and Social Psychology, 39,* 752-766.

Chaiken, S. (1987). The heuristic model of persuasion. In M. P. Zanna, J. M. Olson, & C. P. Herman (Eds.), *Social influence: The Ontario Symposium* (Vol. 5, pp. 3-39). Hillsdale, NJ: Lawrence Erlbaum.

Chang, E. C. (1998). Dispositional optimism and primary and secondary appraisal of a stressor: Controlling for confounding influences and relations to coping and psychological and physical adjustment. *Journal of Personality and Social Psychology, 74,* 1109-1120.

Chang, E. C., D'Zurilla, T. J., & Maydeu-Olivares, A. (1994). Assessing the dimensionality of optimism and pessimism using a multimeasure approach. *Cognitive Therapy and Research, 18*, 143-160.

Chang, E. C., Maydeu-Olivares, A., & D'Zurilla, T. J. (1997). Optimism and pessimism as partially independent constructs: Relations to positive and negative affectivity and psychological well-being. *Personality and Individual Differences, 23,* 433-440.

Chen, M. J., Grube, J. W., Bersamin, M., Waiters, E., & Keefe, D. (2005). Alcohol advertising: What makes it attractive to youth? *Journal of Health Communication, 10,* 553-565.

Colvin, C. R., & Block, J. (1994). Do positive illusions foster mental health? An examination of the Taylor and Brown formulation. *Psychological Bulletin, 116*, 3-20.

Costa, P. T., & McCrae, R. R. (1992). Normal personality assessment in clinical practice: The NEO Personality Inventory. *Psychological Assessment, 4*, 5-13.

Das, E., & Fennis, B. M. (2008). In the mood to face the facts: When a positive mood promotes systematic processing of self-threatening information. *Motivation and Emotion, 32*, 221-230.

Das, E., de Wit, J. B. F., & Stoebe, W. (2003). Fear appeals motivate acceptance of action recommendations: Evidence for a positive bias in the processing of persuasive messages. *Personality and Social Psychology Bulletin, 29*, 650-664.

de Hoog, N., Stroebe, W., & de Wit, J. B. F. (2005). The impact of fear appeals on the processing and acceptance of action recommendations. *Personality and Social Psychology Bulletin, 31*, 24-33.

Ditto, P. H., & Lopez, D. F. (1992). Motivated skepticism: Use of differential decision criteria for preferred and nonpreferred conclusions. *Journal of Personality and Social Psychology, 63*, 568-584.

Dougall, A. L., Hyman, K. B., Hayward, M. C., McFeeley, S., & Baum, A. (2001). Optimism and traumatic stress: The importance of social support and coping. *Journal of Applied Social Psychology, 31,* 223-245.

Epstein, S. (1998). *Constructive thinking: The key to emotional intelligence.* Westport, CT: Praeger.

Epstein, S., & Meier, P. (1989). Constructive thinking: A broad coping variable with specific components. *Journal of Personality and Social Psychology, 57*, 332–350.

Fontaine, K. R., & Jones, L. C. (1997). Self-esteem and optimism, and postpartum depression. *Journal of Clinical Psychology, 53*, 59-63.

Fosnaugh, J., Geers, A. L., & Wellman, J. A. (2009). Giving of a rosy glow: The manipulation of an optimistic orientation. *Journal of Social Psychology, 149*, 249-263.

Geers, A. L., Handley, I. M., & McLarney, A. R. (2003). Discerning the role of optimism in persuasion: The valence-enhancement hypothesis. *Journal of Personality and Social Psychology, 85*, 554-565.

Geers, A. L., Wellman, J. A., & Lassiter, G. D. (2009). Dispositional optimism and engagement: The moderating influence of goal prioritization. *Journal of Personality and Social Psychology, 96,* 913-932.

Geers, A. L., Wellman, J. A., Seligman, L. D., Wuyek, L. A., & Neff, L. A. (2010). Dispositional optimism, goals, and engagement in health treatment programs. *Journal of Behavioral Medicine, 33,* 123-134.

Hatchett, G. T., &. Park, H. L. (2004). Relationships among optimism, coping styles, psychopathology, and counseling outcome. *Personality and Individual Differences, 36,* 1755-1769.

Heckhausen, J., Wrosch, C., & Fleeson, W. (2001). Developmental regulation before and after a developmental deadline: The sample case of "biological clock" for childbearing. *Psychology and Aging, 16*, 400-413.

Janz, N. K., & Becker, M. H. (1984). The Health Belief Model: A decade later. *Health Education Quarterly, 11,* 1-47.

Jemmott, J. B., Ditto, P. H., & Croyle, R. T. (1986). Judging health status: Effects of perceived prevalence and vulnerability. *Journal of Personality and Social Psychology, 50*, 899-905.

Kaiser, C. R., Major, B., & McCoy, S. K. (2004). Expectations about the future and the emotional consequences of perceiving prejudice. *Personality and Social Psychology Bulletin, 30,* 173-184.

Karademas, E. C., Kafetsios, K., & Sideridis, G. D. (2007). Dispositional optimism, generalized self-efficacy and information processing of threat and well-being related stimuli. *Stress & Health, 23,* 285-294.

Kubzansky, L. D., Kubzansky, P. E., & Maselko, J. (2004). Optimism and pessimism in the context of health: Bipolar opposites or separate constructs? *Personality and Social Psychology Bulletin, 30*, 943-956.

Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin, 108*, 480-498.

Lancastle, D. S., & Boivin, J. (2005). Dispositional optimism, trait anxiety and coping: Unique or shared effects on physical health? *Health Psychology, 24,* 171-178.

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping.* New York: Springer.

Leventhal, H. (1970). Findings and theory in the study of fear communications. In Berkowitz L (Ed.), *Advances in experimental social psychology* (Vol. 5, pp. 119-186). New York: Academic Press.

Leventhal, H. (1971). Fear appeals and persuasion: The differentiation of a motivational construct. *American Journal of Public Health, 61,* 1208-1224.

Liberman, A., & Chaiken, S. (1992). Defensive processing of personally relevant health messages. *Personality and Social Psychology Bulletin, 18,* 669-679.

Marshall, G. N., & Lang, E. L. (1990). Optimism, self-mastery, and symptoms of depression in women professionals. *Journal of Personality and Social Psychology, 59,* 132-129.

Matthews, E. E., & Cook, P. F. (2009). Relationships among optimism well-being, self-transcendence, coping, and social support in women during treatment for breast cancer. *Psycho-Oncology, 18,* 716-726.

Miller, S. M. (1987). Monitoring and blunting: Validation of a questionnaire to assess styles of information seeking under threat. *Journal of Personality and Social Psychology, 52,* 345-353.

Miller, S. M. (1995). Monitoring and blunting styles of coping influence the information patients want and need about cancer. *Cancer, 76,* 167-177.

Muller, D., Judd, C. M., & Yzerbyt, V. Y. (2005). When moderation is mediated and mediation is moderated. *Journal of Personality and Social Psychology, 89,* 852-863.

Nicholls, A. R., Polman, R. C. J., Levy, A. R., & Backhouse, S. H. (2008). Mental toughness, optimism, pessimism, and coping among athletes. *Personality and Individual Differences, 44,* 1182-1192.

Peacock, E., & Wong, P. (1996). Anticipatory stress: The relation of locus of control, optimism, and control appraisals to coping. *Journal of Research in Personality, 30,* 204–222.

Pearlin, L. I., & Schooler, C. (1978). The structure of coping. *Journal of Health and Social Behavior, 19,* 2-21.

Petty, E. R., & Cacioppo, J. T. (1979). Issue involvement can increase or decrease persuasion by enhancing message-relevant cognitive responses. *Journal of Personality and Social Psychology, 37,* 1915-1926.

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 19, pp. 123-205). New York: Academic Press.

Petty, R. E., Schumann, D. W., Richman, S. A., & Strathman, A. (1993). Positive mood and persuasion: Different roles for affect under high and low elaboration conditions. *Journal of Personality and Social Psychology, 64,* 5-20.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*, 879-891.

Raghunathan, R., & Trope, Y. (2002). Walking the tightrope between feeling good and being accurate: Mood as a resource in processing persuasive messages. *Journal of Personality and Social Psychology, 83*, 510-525.

Rasmussen, H. N., Wrosch, C., Scheier, M. F., & Carver, C. S. (2006). Self-regulation processes and health: The importance of optimism and goal adjustment. *Journal of Personality, 74*, 1721-1747.

Robbins, A. S., Spence, J. T., & Clark, H. (1991). Psychological determinants of health and performance: The tangled web of desirable and undesirable characteristics. *Journal of Personality and Social Psychology, 61,* 755-765.

Rogers, R. W. (1975). A Protection motivation theory of fear appeals and attitude change. *Journal of Psychology, 91*, 93-114.

Rogers, R. W. (1983). Cognitive and physiological processes in fear appeals and attitude change: A Revised theory of protection motivation. In J. T. Cacioppo & R. E. Petty (Eds.), *Social psychophysiology.* New York: Guilford Press.

Rosenberg, M. (1965). *Society and the adolescent self-image.* Princeton, NJ: Princeton University Press.

Rosselli, F., Skelly, J. J., & Mackie, D. M. (1995). Processing rational and emotional messages: The cognitive and affective mediation of persuasion. *Journal of Experimental Social Psychology, 31,* 163–190.

Ruthig, J. C., Chipperfield, J. G., Newall, N. E., & Perry, R. P. (2007). Detrimental effects of falling on health and well-being in later life: The mediating roles of perceived control and optimism. *Journal of Health Psychology, 12*, 231-248.

Scheier, M. F., & Carver, C. S. (1985). Optimism, coping, and health: Assessment and implications of generalized outcome expectancies. *Health Psychology, 4*, 219-247.

Scheier, M. F., & Carver, C. S. (1992). Effects of optimism on psychological and physical well-being: Theoretical overview and empirical update. *Cognitive Therapy and Research, 16,* 201-228.

Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A re-evaluation of the Life Orientation Test. *Journal of Personality and Social Psychology, 67,* 1063-1078.

Scheier, M. F., Matthews, K. A., Owens, J., Magovern, G. J., Sr., Lefebvre, R. C., Abbott, R. A., & Carver, C. S. (1989). Dispositional optimism and recovery from coronary artery bypass surgery: The beneficial effects on physical and psychological well-being. *Journal of Personality and Social Psychology, 57,* 1024-1040.

Scheier, M. F., Weintraub, J. K., & Carver, C. S. (1986). Coping with stress: Divergent strategies of optimists and pessimists. *Journal of Personality and Social Psychology, 51,* 1257-1264.

Segerstrom, S. C.,Taylor, S. E., Kemeny, M. E., & Fahey, J. L. (1998). Optimism is associated with mood, coping and immune change in response to stress. *Journal of Personality and Social Psychology, 74,* 1646-1655.

Simons, J., & Carey, K. B. (1998). Structural analysis of attitudes toward alcohol and marijuana use. *Personality and Social Psychology Bulletin, 24,* 727-735.

Smith, T. W., Pope, M. K., Rhodewalt, F., & Poulton, J. L. (1989). Optimism, neuroticism, coping, and symptom reports: An alternative interpretation of the Life Orientation Test. *Journal of Personality and Social Psychology, 56,* 640-648.

Solberg Nes, L., & Segerstrom, S. C. (2006). Dispositional optimism and coping: A meta-analytic review. *Personality and Social Psychology Review, 10,* 235-251.

Stephenson, M. T., & Witte, K. (1998). Fear, threat, and perceptions of efficacy from frightening skin cancer messages. *Public Health Reviews, 26,* 147-174.

Steptoe, A., Wardle, J., Vinck, J., Tuomisto, M., Holte, A., & Wichstrom, L. (1994). Personality and attitudinal correlates of healthy and unhealthy lifestyles in young adults. *Psychology and Health, 9,* 331-343.

Taylor, S. E., & Aspinwall, L. G. (1996). Mediating and moderating processes in psychosocial stress: Appraisal, coping, resistance and vulnerability. In H.B. Kaplan (Ed.) *Psychosocial stress: Perspectives on structure, theory, life-course, and methods* (pp. 71-110). San Diego: Academic Press.

Taylor, S. E., & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin, 103, 193-210.*

Taylor, S. E., & Brown, J. D. (1994). Positive illusions and well-being revisited: Separating fact from fiction. *Psychology Bulletin, 116*, 21-27.

Taylor, S. E., Kemeny, M. E., Aspinwall, L. G., Schneider, S. C., Rodriguez, R., & Herbert, M. (1992). Optimism, coping, psychological distress, and high-risk sexual behaviors among men at risk for acquired immunodeficiency syndrome (AIDS). *Journal of Personality and Social Psychology, 63*, 460-473.

Watson, D., & Clark, L. A. (1994). *The PANAS-X: Manual for the positive and negative affect schedule (expanded form).* Unpublished manuscript, University of Iowa.

Witte, K. (1992). Putting the fear back into fear appeals: The extended parallel process model. *Communication Monographs, 59,* 329-349.

Witte, K. (1994). Fear control and danger control: A test of the extended parallel process model (EPPM). *Communication Monographs, 61*, 113-134.

Witte, K., Berkowitz, J., Cameron, K., & Lillie, J. (1998). Preventing the spread of genital warts: Using fear appeals to promote self-protective behaviors. *Health Education and Behavior, 25,* 571-585.

Wrosch, C., & Scheier, M. F. (2003). Personality and quality of life: The importance of optimism and goal adjustment. *Quality of Life Research, 12*, 59-72.

Wrosch, C., Scheier, M. F., Carver, C. S., & Schulz, R. (2003). The importance of goal disengagement in adaptive self-regulation: When giving up is beneficial. *Self and Identity, 2*, 1-20.

Wrosch, C., Scheier, M. F., Miller, G. E., Schulz, R., & Carver, C. S. (2003). Adaptive self-regulation of unattainable goals: Goal disengagement, goal reengagement, and subjective well-being. *Personality and Social Psychology Bulletin, 29*, 1494-1508.

Zuwerink, J. R., & Devine, P. G. (1996). Attitude importance and resistance to persuasion: It's not just the thought that counts. *Journal of Personality and Social Psychology, 70,* 931-944.